

S

338.1

A63r

1905

Montana State Library



3 0864 1004 5727 7



MR. W. M. WOOLDRIDGE,
FIRST PRESIDENT OF THE MONTANA AGRICULTURAL ASSOCIATION.
HINSDALE, MONT.



PROF. R. W. FISHER,
HORTICULTURIST, MONTANA AGRICULTURAL EXPERIMENT STATION,
BOZEMAN, MONT.

FOURTH ANNUAL REPORT

OF THE

Montana

Farmers' Institutes

For the year

Ending November 30, 1905

AUTHORIZED BY

The Administrative Board

Farmers' Institutes

Edited by F. B. LINFIELD, Secretary

"INDEPENDENT PUBLISHING COMPANY, HELENA, MONTANA."



Letter of Transmittal.

Bozeman, Mont., March 1, 1906.

To His Excellency, Joseph K. Toole,

Governor of Montana:

Dear Sir—I have the honor to transmit herewith the Fourth Annual Report of the Montana Farmers' Institutes.

Very respectfully,

F. B. LINFIELD,

Secretary.

Montana Board of Administration of Farmers' Institutes.

Directors.

J. K. Toole, Governor	Ex-Officio
T. C. Power, Pres. Wool Growers' Association.....	Helena
J. M. Holt, Pres. Stock Growers' Association	Miles City
C. F. Dallman, Pres. Horticultural Society.....	Missoula
F. L. Benepe, Pres. Registered Cattle Breeders' Assoc..	Bozeman
J. O. Read, Pres. State Board of Horticulture.....	Hamilton
W. W. Wylie, Pres. State Agricultural Society.....	Bozeman
F. B. Linfield, Director Montana Experiment Station..	Ex-Officio

Officers of the Board.

W. W. Wylie	President
F. B. Linfield	Secretary

Executive Committee.

Gov. J. K. Toole	Helena
W. W. Wylie	Bozeman
F. B. Linfield	Bozeman

CONTENTS.

	Page
Board of Administration	3
Farmers' Institute Law	6— 7
Secretary's Report	9— 14
THE FARM HOME—	
Permanent Rural Homes by W. M. Wooldridge, Hinsdale	15— 19
The Betterment of Farm Homes by W. B. Harlan, Como	20— 23
Village Improvement by Mrs. F. E. Marshall, Agri. College, Bozeman.	25— 28
Flowers for the Home and Garden by C. F. Dallman, Missoula	29— 31
How to keep the Boys and Girls on the Farm by Mrs. D. S. Williams, Whitehall	31— 34
The Improvement of the Farmers' School by Prof. O. T. Bright, Chi- cago, Ill.	35— 70
Landscape Gardening by Prof. R. W. Fisher, Agri. College, Bozeman...	71— 78
The Improvement of Home Grounds by F. Crane-field, Madison, Wis ...	79— 86
The Home Water Supply by Prof. V. K. Chesnut, Agri. Coll. Bozeman..	87— 94
How to Keep the Boy on the Farm by Prof. Morton J. Elrod, State Uni- versity, Missoula	94—103
ROADS AND HIGHWAYS—	
Public Highways by J. M. Burlinghame, Belt	104—114
A Plea for Good Roads by Prof. E. Tappan Tannatt, Agricultural College, Bozeman	111—114
The King Drag by Prof. E. Tappan Tannatt, Agricultural College....	115—118
FIELD CROPS—	
Alfalfa Growing by W. W. Wylie, Bozeman	119—128
Crop Rotation by Prof. A. Atkinson, Agricultural College, Bozeman...	129—131
Originating and Testing Varieties by Prof. F. B. Linfield, Agricultural College, Bozeman	132—136
Waste Products of the Farm and How to Use Them by Fred Whiteside; Kalispell	137—142
The Improvement of Our Farming by Prof. F. B. Linfield, Agricultural College, Bozeman	142—154
Sugar Beet Growing by W. M. Oliver, Dillon	155—160
IRRIGATION—	
Irrigation Canals by Prof. E. Tappan Tannatt, Agri. College, Bozeman.	161—171
Co-operative Canal Construction by W. M. Wooldridge, Hinsdale	171—175
Intensive Farming by Aid of Irrigation by Prof. F. B. Linfield, Agri- cultural College, Bozeman.....	176—182
HORTICULTURE—	
Apples, Varieties, Packing and Marketing by Henry Buck, Stevens- ville	183—186
Winter Apples for Montana by C. H. Edwards, Butte	186—188
Small Fruits by T. T. Black, Whitehall	189—200
Truck Farming by H. C. B. Colville, Missoula	200—204
What to Do With the Unsalable Fruit by Thomas McClain, Carlton	205—213
Horticultural Inspection by Prof. R. A. Cooley, Agricultural College, Bozeman	213—227

	Page
LIVE STOCK—	
The Future of the Sheep Industry by E. O. Selway, Dillon	228—229
What Agricultural Development Means for the Live Stock Interests by Prof. F. B. Linfield, Agricultural College, Bozeman	230—234
The Sheep Industry in Its Relation to Range and Farm by Prof. F. B. Linfield, Agricultural College, Bozeman	235—241
DAIRYING—	
The Beaverhead Dairy Cow by Louis Stahl, Dillon	242—246
The Cream Market of Montana by W. J. Elliott, Agricultural College, Bozeman	246—249
POULTRY—	
Farm Poultry House by James Dryden (Bulletin Utah Exp. Station) ..	250—251
The Poultry Business as a Profit Maker by James Dryden, Bozeman ..	252—258
MISCELLANEOUS—	
Address to the State Horticultural Society by Col. W. F. Sanders, Helena	259—262
Discussion of the Montana Horticultural Law by Col. W. F. Sanders, Helena	263—268
The Farmer and Merchant by F. J. Erfert, Missoula	268—271
A Word to the Ranchmen by G. R. Featherley, Dillon	272—275

**State Law Providing for Farmers' Institutes as Amended by the
8th Legislative Assembly.**

Be it Enacted by the Legislative Assembly of the State of Montana :

Section 1. That Section 1 of said Act be and the same is hereby amended so as to read as follows :

Section 1. The Board of Administration of Farmers' Institutes, as provided for in this Act, shall consist as follows :

The Governor of the State and the Director of the Montana Experimental Station, both of whom shall be ex-officio members and the presidents of the following named organizations :

The Montana Registered Cattle Breeders' Association, the Montana Woolgrowers' Association, The Montana Livestock Association, The Montana Horticultural Society, The Montana State Board of Horticulture, The Montana Agricultural Association and the Montana Dairymen's Association, when these last two shall have been duly organized. Members of such Board of Administration shall be designated the "Directors of the Montana Farmers' Institutes," and shall be authorized to hold Institutes for the instruction of the citizens of this State in the various branches of agriculture, and shall prescribe such rules and regulations as they may deem best for organizing and conducting the same. Such Institutes shall be held at least once in each county in each year and at such times and places as the directors may designate; provided, the requirements of the Board of Administration have been complied with, such as County Institutes or local organizations providing a suitable hall, lighting and heating the same, and bearing necessary advertising expense. The directors may employ an agent or agents to perform such work in organizing or conducting such Institutes as they may deem best. A course of instruction at such Institute shall be so arranged as to present to those in attendance the results of the most recent investigations in theoretical and practical agriculture.

Section 2. For the purpose mentioned in this Act, the Directors may use the sum as they deem proper, not exceeding the sum of Four Thousand Dollars (\$4,000.00) per annum, and that until otherwise provided by law the State Treasurer shall pay,

out of any money in the State Treasury not otherwise appropriated, a sum not to exceed Four Thousand Dollars (\$4,000.00) during each fiscal year hereafter, on the order of the said Board of Directors. Each Institute held under the authority of this Act, shall be entitled to a sum not exceeding Fifty (\$50.00) Dollars from the amount appropriated under this Act.

Section 3. That Section 5 of this Act be and the same is hereby amended so as to read as follows:

Section 5. That immediately upon the passage and approval of this Act the Board of Administration shall meet in the City of Helena and arrange for the first series of Institutes throughout the State, and thereafter such Board shall meet annually on the second Tuesday in September to arrange for such Institutes, and they shall again meet on the second Tuesday in March of each year to audit all expenditures and arrange for the printing in pamphlet form, within sixty days of said meeting, of the "Institute Annual," and that the cost of said Annual shall not exceed One Thousand Five Hundred Dollars (\$1,500.00) in any one year.

Section 4. That all Acts and parts of Acts in conflict with the provisions of this Act be and the same are hereby repealed.

Section 5. This Act shall take effect from and after its approval.

B. F. WHITE,

Speaker of the House of Representatives.

JAMES P. MURRAY,

President Pro Tem, President of the Senate.

Approved March 6th, 1903.

JOS. K. TOOLE, Governor.

Filed March 6th, 1903 at 5:45 P. M.

GEO. M. HAYS, Secretary of State.

REPORT OF SECRETARY.

The work of the Farmers' Institutes is growing and developing. Through a systematizing of the work it has been possible to increase the number of meetings and sessions held each year and yet keep inside the appropriation. The result has been that we have been able to reach a larger number of people. The progress of the work is well shown in the following table:

Year	Number of Towns	Number of Days	Number of Sessions	Attendance at Meetings	*Funds Spent
1901-2	17	22	No report.	.....	\$2,630.05
1902-3	33	35	43	1,543	2,936.44
1903-4	39	43	72	4,439	3,950.47
1904-5	47	53	100	6,946	4,000.00
1905-6	63	77	133	7,890	4,000.00

* Includes the printing and distribution of an annual report of over 200 pages in a 5,000 edition.

Up to the end of the year 1902-3 nothing further than the traveling expenses of the institute workers was paid from the institute fund. Since that time a small per diem has been paid to the workers and the Secretary and Superintendent has been provided with some office help. With the increase in the number of meetings and the time devoted to this institute work, the difficulty of getting speakers has increased and during the past two years has resulted in disappointment in many cases and thus loss to the work. The situation seems to call for the employment of a regular institute corps, at a fixed salary for the winter season. This will call for additional expense. As we have already reached the limit of expansion under our present plans of work, the proposed plan will necessitate the securing of additional funds from the legislature or a reduction in the number of meetings and of the time devoted to this work. As to what shall or shall not be done in this matter rests in a large measure with what the people desire to have done.

The meetings for the past year have been quite successful but we do not feel that we have even yet attained all the success we would like, nor have we reached as many people as should be interested and benefited by the meeting. We would be pleased to

get any suggestions on matter of advertising or on any other matter that it was thought would be helpful to the work.

In one direction we feel that considerable should be done towards presenting topics that would be interesting and valuable to the ladies of the rural homes. Some little in this direction has been done but the lack of efficient help and of funds has prevented any definite plans in this direction. On this point also we would be very pleased to hear from the friends of the work and particularly the ladies.

A full detailed report of the meetings for the past year (1904-5) is herewith given.

List of Institute Meetings Held During the Season 1904-5, and Assignment of Speakers.

DISTRICT NO. 5.

Deputation Sent by the Board.

Prof. M. J. Elrod.

F. B. Linfield.

T. T. Black.

County.	Town.	Date of Meeting
Park	Livingston	Nov. 21.
Sweetgrass	Bigtimber	Nov. 22.
Yellowstone	Columbus	Nov. 23.
Yellowstone	Park City	Nov. 24.
Yellowstone	Billings	Nov. 25 and 26.
Carbon	Joliet	Nov. 28.
Carbon	Bridger	Nov. 30.
Rosebud	Forsyth	Dec. 2.
Custer	Miles City	Dec. 3.
Dawson	Glendive	Dec. 5.

DISTRICT NO. 3.

Deputation Sent by the Board.

R. W. Fisher.

E. Broox Martin.

Dr. H. C. Gardiner.

Lewis and Clark	East Helena	Jan. 11.
Beaverhead	Dillon	Jan. 12.
Beaverhead	Red Rock	Jan. 13.
Madison	Twin Bridges	Jan. 16.
Madison	Ferguson	Jan. 18.
Jefferson	Pleasant Valley	Jan. 19.
Jefferson	Summit Valley	Jan. 21.

DISTRICT NO. 2.

Deputation Sent by the Board.

T. T. Black.

Fred Whiteside.

F. B. Linfield.

Dr. S. W. McClure.

Missoula	Plains	Feb. 6.
Missoula	Missoula	Feb. 7 and 8.
Ravalli	Darby	Feb. 9.
Ravalli	Corvallis	Feb. 11.
Ravalli	Stevensville	Feb. 13.
Granite	Hall	Feb. 14.
Powell	Helmville	Feb. 16.
Powell	Peer Lodge	Feb. 18.

DISTRICT NO. 1.

Deputation Sent by the Board.

I. D. O'Donnell.	A. Atkinson.	Dr. S. W. McClure
Cascade	Cascade	Feb. 20.
Cascade	Belt	Feb. 21 and 22.
Teton	Choteau	Feb. 24.
Flathead	Kalispell	Feb. 27.
Flathead	Bigfork	Feb. 28.
Flathead	Fairview	March 1.
Choteau	Chinook	March 3.
Choteau	Harlem	March 4.
Valley	Malta	March 6.
Valley	Hinsdale	March 7.
Valley	Culbertson	March 8 and 9.

DISTRICT NO. 4.

Deputation Sent by the Board.

W. B. Harlan.	George R. Featherley.	W. J. Elliott.
John W. Pace.	W. W. Wylie.	
Gallatin	Manhattan	March 22.
Gallatin	Belgrade	March 23.
Gallatin	Bozeman	March 24 and 25.
Meagher	White Sul. Springs.	March 27 and 28.
Fergus	Lewistown	March 30.
Fergus	Moore	March 31.
Broadwater	Townsend	April 3.
Broadwater	Crow Creek	April 4.

Detailed Report of the Institute Meetings for the Year 1904-5,
Giving Towns, Date of Meeting and Attendance.

DISTRICT NO. 1.

Town	Date of Meeting	Attendance at each session					Total Attendance
		1st	2d	3d	4th	5th	
Cascade	Feb. 20	57	53	.....	.....	.....	.....
Belt	Feb. 21 and 22	150	210	75	200	.....	.....
Choteau	Feb. 24	79	89	.....	.....	.....	.....
Kalispell	Feb. 27	200	100	.....	.....	.....	.....
Bigfork	Feb. 28	47	65	.....	.....	.....	.....
Fairview	March 1	30	28	.....	.....	.....	.....
Chinook	March 3	130	120	.....	.....	.....	.....
Harlem	March 4	45	150	.....	.....	.....	.....
Malta	March 6	38	45	.....	.....	.....	.....
Hinsdale	March 7	42	48	.....	.....	.....	.....
Culbertson	March 8 and 9	40	100	.....	.....	.....	2,220

DISTRICT NO. 2.

Plains	Feb. 6	100	100	.....	.....	.....	.....
Darby	Feb. 9	50	60	.....	.....	.....	.....
Stevensville	Feb. 13	100	300	.....	.....	.....	.....
Hall	Feb. 14	50	65	.....	.....	.....	.....
Helmville	Feb. 16	30	100	.....	.....	.....	.....
Deer Lodge	Feb. 18	40	50	200	.....	.....	.....
Corvallis	Feb. 11	50	65	.....	.....	.....	.....
Missoula	Feb. 7 and 8	30	50	50	30	75	1,595

FOURTH ANNUAL REPORT OF THE

DISTRICT NO. 3.

Willow Creek	Jan. 21	35	50	.....	.....	.....	.....
Ferguson	Jan. 20	20	25	.....	.....	.....	.....
Pleasant Valley	Jan. 18	60	95	.....	.....	.....	.....
Summit Valley	Jan. 19	30	75	.....	.....	.....	.....
Twin Bridges	Jan. 16	75	130	.....	.....	.....	.....
Dillon	Jan. 12	50	75	130	100	50	.....
East Helena	Jan. 11	20	.....	.....	.....	.....	1,020

DISTRICT NO. 4.

Bozeman	March 25	25	40	35	50	120	.....
Manhattan	March 23	30	45	.....	.....	.....	.....
Townsend	April 3	40	60	.....	.....	.....	.....
Crow Creek	April 4	50	75	.....	.....	.....	.....
White Sul. Springs	Mar. 27 and 28	75	100	.....	.....	.....	.....
Lewistown	Mar. 30	40	75	.....	.....	.....	.....
Moore	Mar. 31	30	50	20	60	.....	1,020

DISTRICT NO. 5.

Livingston	Nov. 21	40	50	.....	.....	.....	.....
Big Timber	Nov. 22	20	40	.....	.....	.....	.....
Columbus	Nov. 23	45	75	.....	.....	.....	.....
Park City	Nov. 24	35	75	.....	.....	.....	.....
Joliet	Dec. 28	60	50	.....	.....	.....	.....
Bridger	Dec. 30	75	60	.....	.....	.....	.....
Forsyth	Dec. 2	75	.....	.....	.....	.....	.....
Miles City	Dec. 3	30	.....	.....	.....	.....	.....
Glendive	Dec. 5	75	.....	.....	.....	.....	.....
Newlon	June 19	35	.....	.....	.....	.....	.....
Sidney	June 20	45	50	.....	.....	.....	.....
Ridgelaun	June 21	20	50	.....	.....	.....	.....
Fairview	June 21	45	.....	.....	.....	.....	.....
Tokna	June 21	30	.....	.....	.....	.....	1,080

For the year, meetings were held on 53 days, with 101 sessions and a total attendance of 6,944.

Financial Statement for the Year Ending November 31, 1905.

Expense of Administrative Board	\$ 91.55
Traveling Expense of Institute Workers	1,448.73
Per Diem to Institute Workers	486.00
Clerk and Stenographer	608.15
Postage and Stationery	115.20
Advertising ..	201.90
Freight, Express and Drayage	53.81
Illustrative Material	43.45
Printing Bulletin No. 2	27.29
Fourth Annual Report, 5,000 copies: 500 found in cloth.	1,030.88
Total.....	\$4,106.06

The financial statement shows how the funds given for the Farmers' Institute work was spent. It will be noticed that almost half of the \$4,000.00 appropriated goes to pay the expenses of the Institute workers and the Board. Of the remainder about one-half goes to advertising and office expense and one-half to the printing of the annual report.

It will be noticed that for this year a small per diem has been paid to the Institute workers. It was felt that we could not longer ask these men to sacrifice their time and also to hire some person to do the work at home while they were gone as some of these men had to do.

Acknowledgments.

As in previous years we are indebted to several of our successful farmers for help at these institute meetings. We are especially indebted to Mr. T. T. Black, Mr. I. D. O'Donnell, Mr. E. Broox Martin, Mr. Fred Whiteside, and Mr. W. B. Harlan, who at considerable sacrifice of time and convenience made trips around the districts. We are also much indebted to the Bureau of Animal Industry of the U. S. Department of Agriculture for delegating Dr. S. W. McClure to help us without expense to the Institute fund.

Prof. Elrod of the State University and all the members of the Experiment Station Staff have given willingly of their time to this work. In fact, without their aid, these meetings could not have been made as valuable or as interesting as they were.

To the railways of the state we are also under obligation for transportation for the Secretary and Superintendent and for free carriage of the annuals. To the Great Northern we are further indebted for transportation for some of the Institute workers.

Preface.

In the last Farmers' Institute annual we planned to present a fairly complete writeup of one topic, viz: alfalfa. The plan seemed to be well received in fact so well, that this edition of the annual is practically exhausted. For this 4th report we thought to present some facts pertaining to the fitting up of the rural home on a permanent and home like basis. The papers and illustrations dealing with these topics will therefore be grouped together at the beginning of the report. In preparing this part of the report we have not confined ourselves to the papers presented at the meetings but have gathered material from other sources to make the topic as complete as possible.

At the meeting of the State Horticultural Society held in Helena in January, 1905, the late Col. W. F. Sanders was a regular and very interesting visitor. At the request of the President of the Society, Col. Sanders addressed the Society and later at the request of a member took part in a discussion on the enforcement of the Horticultural law. As this was probably the last appearance of Col. Sanders before a public audience and his words are so well chosen and full of wisdom that they are worthy of the consideration and study of all the people of the state. In this report we give them a wider audience.

The address of Prof. O. T. Bright of Chicago, as given before the Illinois Farmers' Institute at Joliet, Ill., will call to mind many familiar scenes in the rural districts of Montana. Where such enormous crops can be grown under irrigation but a small area of land is needed to support a family in comfort. With a family on every 40 to 80 acres of land the country becomes thickly populated and all the conveniences of the town may be had on the farm and among them the consolidated and graded school.

Prof. Bright has said so well what applies most aptly to many parts of Montana and the cuts which have been very kindly loaned without cost by the Superintendent of the Farmers' Institutes of Illinois, Prof. Hall, illustrates those points so fully that the address will be equally as valuable as anything written especially for Montana.

F. B. LINFIELD,
Secretary.

THE FARM HOME.

PERMANENT RURAL HOMES.

By W. M. Wooldridge, Hinsdale, Montana.

How dear to the human heart is the little word "Home" and how intimately connected with every day of our existence here upon earth.

The subject assigned me not only relates to homes in general, but permanent homes and rural homes.

In European countries the word "home" means a permanent abiding place for that particular family, not through one, but several generations: Around it cluster the memories of their fathers and forefathers for generations back. The different branches of any particular family look back to their ancestral home with pride and veneration. To this each succeeding generation adds its share, so that no consideration would cause them to part with it.

The English people in particular have this home-building instinct strongly developed, so that even the poorest tenant, and poorest people, take pride in maintaining their ancestral home, although it may only be a rented one, but occupied by the family for several generations. It was largely due to this National characteristic and early laws of England to encourage it, that has resulted in that great nation becoming "Mistress of the Seas", as in these homes they possessed a bulwark of national strength difficult to overcome. A student of English History is impressed with the wisdom of such legislation; the yeomanry of England won from the crown and lords over a thousand years ago what the Russians are now struggling for.

The younger members of prominent English families when transported to every corner of the known earth carry with them this national trait, and when once established take steps to build up new homes. I was forceably impressed by this fact when visiting Victoria, B. C. some two years ago, and noting their magnificent homes, built by younger sons of prominent English families.

. It was due to this racial instinct that so many fine colonial homes such as Mount Vernon, Arlington and others found in Virginia, and other older states were built by the earlier American settlers; the Washington Home at Mount Vernon, and the Lee Home at Arlington being merely types of the early American idea, that have endured through several generations.

How vastly different is the situation in the United States in general, and in Montana in particular. With us the prevailing idea seems to consider only the present; the future can take care of itself. It seems to be the general impression to first secure a fortune then go elsewhere to spend it. In Montana especially very few of our people seem willing to make any provision to establish a permanent abiding place; home with them is merely a means to an end. Four walls covered with a roof seem to be about all that is desired, and thus little or nothing is done towards permanency. Too many of our people seem to consider their present locality a good one in which to obtain a start, but not a place to stay. This engenders a general spirit of unrest, while nine times out of ten, when the final move has been made, it results in disappointment.

President Roosevelt has fittingly said "that in the multiplication of our rural homes lie the safety of the Nation." The owners of rural homes in any country are looked upon by statesmen and close students of history as the real strength in a national crisis. As a rule they are conservative, level headed people, who are not swayed by every passing breeze.

The rural home need not necessarily be an expensive one, yet it should be the ambition of every American farmer to own a home of his own, that will endure through all of his mortal days, and even though that of his children. Plans should be laid out with this object of permanency in view. Even the poor man just starting out should make every calculation with this as an object. Even though it should be a log house, it should be built in the belief that it was Home in every sense, where the wife and children were to reside, where trees and shrubs should be set out, and general plans for the future devised and worked up to as time progresses.

In that portion of Ohio from whence I came, the early settlers seemed to have possessed well defined ideas along this line. On many places were to be seen two or more log houses representing

as many generations of hardy men and women, and along side of these would be seen the more modern up-to-date farm home with all its conveniences, still occupied by the descendants of the old settlers who had long passed away. Every surrounding denoted this fixity of purpose on the part of the first settlers in planning their homes. Still these old log buildings were jealously and carefully guarded as family mementos.

I would most earnestly appeal to every person within the hearing of my voice, or my pen to banish the all too common idea, that in some other corner of the world lie better opportunities to obtain wealth, or comfort. It is this National characteristic to move that has resulted in much profitable business for the railways in the United States. Too many have persuaded themselves to sell out, and seek better conditions elsewhere, which has in many instances, resulting in disappointment and financial loss or perhaps ruin. The conditions surrounding us are largely of our own making, and can be greatly improved if we will it so.

So far I have been confining my remarks to those already possessing homes. To those who do not, and who are just starting out in life my advice would be to secure one as speedily as possible, and if you are of an agricultural turn of mind, see that it is in a good farming section, and even if it only be five acres make a start, adding to it as rapidly as your means will allow.

In planning permanent homes, allow plenty of land for the house lot; plan for the vegetable garden to be within this enclosure; the orchard could also be so included, as well as the small fruit garden. On the ordinary 160 acre farm five acres is none too much for this purpose. Plan to have the dwelling placed back at least 100 feet or more from the public highway, as this will give space for a lawn. Do not plant trees too closely to the house. Allow wide open stretches of lawn immediately surrounding the house, plant shrubs and trees along the borders, and plan as much as possible that the lawn shall be clipped by the mower or other horse power machine. The vegetable garden should be in the rear of the house, and it is a good plan to have it screened off by an arbor fence covered with vines.

Provide for the barns and other outbuildings to be placed at some little distance from the dwelling, and so located that the prevailing wind will not carry any unpleasant smells to the house.

Arrange for the sunny side of the house to be the dining and

general living rooms of the dwelling. It is well to have the out-buildings on the same side of the dwelling so that they can be observed at all times. Ours is so arranged, and we can at all times note the stock and general trend of affairs and besides the sunny windows can be filled with plants during the winter.

Where plans are being prepared for a permanent dwelling, choose its location as soon as possible, although several years may elapse before the structure may be built. Plant suitable trees after a well prepared landscape plan. These may be growing while your own financial plans are being matured, and will add considerable to the attractiveness of the farm, and greatly enhance its value. Let the children plant certain trees to claim as their own; in after years they will cherish the privilege.

When you are ready to actually build, do not make the too common mistake of being persuaded "that any good carpenter can prepare plans of your house." This is a grievous mistake as many have learned to their cost. The preparation of plans, specifications, and estimates, including contract for mason, carpenter, and other artisan work is one requiring technical and skilled experience in that particular line; one requiring years of preparation. Such plans, remodded after your own wants can be so cheaply secured now-a-days that it does not pay to take chances. Plans including blueprints, lumber list and complete detail can be secured as low as \$15 for a \$1,000 house and \$30 to \$50 for a \$5,000 dwelling, and a small mistake may cost several times this amount.

After plans have been secured, seek a capable and honest contractor and submit them to him for his estimate for building by contract, as we believe that much can thus be saved, over letting the work out by the day.

If the architect lives near it is advisable to employ him to make one or more trips of supervision during construction. His trained eye will readily detect faulty construction which would pass unobserved by you.

Do not make the all too common mistake of attempting to build during the late fall or winter, we would prefer to begin operations as early in spring as weather will permit, and have the building completed ready for winter occupancy. Under no circumstances use wet or green lumber. If the building is erected during the summer the lumber can be quickly dried by racking it up so that the wind will pass between the boards.

I would never build even a bunk house without plastering it, it is warmer, cleaner and in every way better.

A farm house requires a much larger kitchen than the ordinary city dwelling. There are so many more uses for it on the farm, and at times during the spring or muddy weather where much help is employed it may be necessary to use it as a dining room to save housework especially where domestic help is scarce.

We are rather inclined to favor one general building rather than several separated ones. The laundry, milk room, and wood shed can well be built in the close vicinity of the kitchen, and under the one roof. This saves steps, and much useless running about to attend to the various work of the ordinary farm house. We noted recently in one of our Montana Agricultural papers a plan of a farm dwelling embodying these features, which appeared the most complete ever attracting our attention.

In closing, allow me to say that we will live this life but once, our home is about the only real satisfaction that we will ever get out of life. In it we will live, here our children will be born, and here finally our own eyes will close upon earth's scenes. Let us make it the one single place of comfort and refuge from business cares, let it prove to be all the word implies, and above all let it be permanent and built with that object in view.

A number of valuable bulletins have been published by several of the state experimental stations, and the U. S. Department of Agriculture that would assist very materially those about to lay out or build a home. Those especially attracting my attention were:

Cornell N. Y. No. . . "Beautifying Home Grounds."

North Dakota No. 25, "Tree Planting."

U. S. Department of Agriculture.

Farmers' Bulletin No. 126, "Practical Suggestions of Farm Buildings."

Farmers' Bulletin No. 185, "Beautifying Homegrounds."

It would certainly pay any one interested to write and secure copies of these, as they are sent free.

THE BETTERMENT OF FARM HOMES.

By W. B. Harlan, Como, Montana.

While we are striving to make our farms productive and more profitable, to raise larger and better crops of grain and hay, of vegetables and fruit, and while we are devoting much time, thought, and money to the improvement of the stock upon the farm, let us pause and see what we have done, and are doing for the home itself,—the home where all our interests are centered, where so large a portion of our lives are, or should be spent, and where the wife and children either live or exist as the case may be.

Does it compare favorably with the rest of the farm? Is it comfortable, convenient, attractive; is it one in which we and our families are contented and happy and willing to live during the years to come? Are we proud of its arrangements and appearance?

Many a farmer will show his friend or visitor with pride over the ranch, pointing out the big stacks of hay or grain, the full granaries, the roomy and convenient barn where his fine stock is so well cared for and comfortable, the broad acres well fenced and well cultivated, the fine garden and bearing orchard, but when it comes to the house itself he is a little shy about showing it off. In fact he is just a little ashamed of it and of its poverty stricken appearance.

Far too many of our farms and stock ranches have upon them no homes in the truest sense of the word. A few rude buildings, generally lacking in paint; a well, located off some distance from the house—presumably to give the housewife needed exercise; a wood pile also more or less distant, without cover or shelter from rain or snow, for dry wood burns up so very fast. The chickens and pigs keep the grass from growing in the yard and also make the cultivation of flowers impossible. Often no shade trees to break the wintry winds or protect from the glaring summer sun. Nothing convenient, comfortable or attractive. Nothing in which the occupants can take any pride.

Living in such a home, no man can be at his best either as an individual or as a member of the community or as a citizen of the state.

He is generally all too willing or anxious to sell out and move to some other country or state, where he imagines conditions are better, perhaps to his old home, fondly remembering that as the

only God's country, not realizing that each locality has its advantages and its disadvantages and that our homes and our lives and our happiness are much as we choose to make them and that this would be God's country itself if we each did our share towards making it such.

Why is it that so many farmers and stock ranchers continue to live in such poor homes, compared with the homes of men of equal means who live in the towns or cities? The American farmer is worthy of and entitled to the best home and the best of every thing his means will provide. He has earned it and has come honestly by what property he has.

No man or woman has been robbed or is the poorer because of his accumulations, which cannot be said of those who have made their money by speculations or stock gambling. And then the farm is permanent and improvements placed thereon are not wasted. Towns may grow or towns may die, but the farm is there forever, and nothing can be lost in making it as desirable as possible in every way.

Notice how the resident of the town or city builds and beautifies his home. He may be a professional man, a mechanic or a tired and retired farmer. His home, probably planned by a competent architect, is roomy, comfortable and convenient, and built with some regard to taste and style. It is well painted in colors that harmonize with the surroundings and are pleasing to the eye. It has broad piazzas with hammocks and easy chairs where one may rest and enjoy life at the same time. He connects his house with the city water works, and has hot and cold water under pressure in kitchen, pantry, bath room, etc. Good walks surround the house and connect with the side walks on the street in front, and he makes it interesting for the city if the sidewalk is not extended to his place at once. Gas or electric lights are put in and a telephone also must be had to connect him with the central exchange. The yard is well and neatly fenced and grass and flowers are grown therein instead of hogs and chickens. Ornamental and shade trees are planted that soon add to the beauty of the place and the neighborhood, and in every direction effort and money have been freely spent to make a comfortable, attractive, homelike home.

Now there is no good reason why the farmer should deny himself the comforts and even the luxuries of life that are within his

reach. Between now and his death-bed will be the only time he will have on earth, and if he does not do his best to make it pleasant for himself and others while here, he will be forever a loser.

There is no valid excuse for the person who lives upon the farm being content with the bare necessities of life, and so grudgingly paying for the betterment of his home; and it often requires so little either in the planning, or in labor, or money to make a vast difference in the convenience, comforts, and appearance of a home.

There are very few farms in Montana where water cannot be brought into the house in pipes, either by gravity from some spring or creek, or forced there by an hydraulic ram which is cheap and everlasting and requires no attention, and can be used wherever a fall of four or five feet can be had, from creek, spring or ditch. The ram will automatically force the water to almost any height, but if the supply is not regular or freezes up in winter, a storage tank will be necessary, placed high enough to furnish pressure in the house.

Of course, a water front will be put in the stove or range connecting with the hot water tank, which may be a barrel, and from there led by pipes to kitchen, pantry, bathroom, etc. A bathroom and bathtub will be provided, for bathing facilities are a necessity and a luxury, and nowhere so much as on the farm where too often the only way a bath can be had is from a tin basin and a pint or so of water.

A great convenience is a laundry or wash room, which may be an enlarged bathroom where stationary wash tubs are put in. They may be made of plank with three or four compartments and provided with drain pipes for carrying off the water, and if arranged so they can be filled by pipes or hose, a great saving of labor will be made. Such a wash room takes the slop and steam and muss from the kitchen to the great relief of all.

Another great convenience and wood and labor saver, is a steamer, which costs about \$20.00, placed in the wash room and connected with the tubs by pipes. The water and clothes are boiled in the tubs by the steam. It saves boiling the clothes on the kitchen stove, takes but little wood for a day's washing and is in every way satisfactory. We have had one in our house for twenty years and the women folks say they would not keep house without it.

Drains should lead from the pantry sink, bath tubs, and wash tubs, and the waste water be so disposed of that there can be no contamination of the well or spring and no offense to the eyes or nostrils.

Nor is a farmer of ordinary means, longer compelled to put up with the old smoky kerosene lamp for lighting his home. Acetylene gas is as much superior to the oil lamps as they were to the tallow dips they displaced. The acetylene light is better, brighter, easier on the eyes and far less trouble and very much safer than oil lamps. After the first cost of procuring generator and piping the house, the cost of light is less than with coal oil, probably 25 per cent less with the same amount of light. My plant for a fifteen room house, 18 lights, cost ready to turn on the light \$109.00.

Do not make the mistake of getting too small a generator as it has to be refilled oftener. Mine holds 35 pounds of carbide and it takes ten minutes to refill, which has to be done about once a month in winter and once in three months in summer, (according to the amount of light used), and that is all the care or attention required. No breaking of lamps or chimneys, no filling or cleaning or putting in new wicks. I would not exchange it for any light I have yet seen at any price.

Farmers should supplement the rural delivery of the daily mail which now serves nearly every community, with the rural telephone. Montana is rather behind other states in installing this convenience that so soon becomes a necessity, but many farm neighborhoods have it and all soon will enjoy and use it. Where wire fences are common, a rural telephone line can be put in very cheaply and quickly and it is very effective and satisfactory thus built.

By thus taking advantage of the means within his reach it is possible for the farmer to make his farm home the most desirable of any, and thus add not only to his happiness and to that of his family, but enhance the value of his farm, and the community and the state will be the gainer as well as himself.

A HANDY COLD ROOM.

By W. B. Harlan, Como, Montana.

Among the improvements which may be added to the farm house is a cooling room where all who have ice stored for summer use, and what progressive farmer has not, can keep fresh meats, vegetables, fruits, berries, milk or cream, cold and fresh during the hottest of weather. It is convenient, cheap, serviceable and saves must waste and loss.

I have one in mind built as follows: A room was built 4x5 feet in size and 8 feet high in the center, with a double pitch roof. It had an ante-room of the same size, making the house 4x10 inside with double walls filled with chaff or shavings. The floor and roof were also double and filled the same way. There were small double windows in each room which had close fitting doors.

In the cold room is a galvanized sheet iron pan set on scantling, overhead from which a pipe or hose drain carries the water outside.

In this pan are put blocks of ice resting on sticks or pieces of 2x4 to keep the ice out of water. The ice is put in through an opening in the gable end of the house, which is closed by double shutters. The pan is simply a sheet of galvanized iron with sides and ends turned up three or four inches. The corners can easily be turned back so as not to leak without the necessity of soldering.

A cake of ice 10 inches thick and 20 inches square keeps this room cold for three days in the hottest weather.

The ante-room can be used for straining milk and keeping many things that do not require so much cold as is had in the other room, and it also serves to prevent the cold air in the other room from passing out too rapidly when entered.

Of course, this cold room should be located near the kitchen door, or better still, open out of kitchen or pantry.

VILLAGE AND TOWN IMPROVEMENT.

By Mrs. F. E. Marshall.

There is a saying that "Character is destiny."

This is undoubtedly as true of corporate bodies as of individuals. There are, then, two questions for us to study.

What we most desire as the future destiny of the town in which we live and what is the present character of that town?

Those who live in a place have many interests connected with it, social, political and financial. Our own comfort, and the comfort, health, morals, manners and education of our children, and their fitness for success in business, and in good society depend greatly upon the character of the place in which we live. Can we so order the town that it shall be destined to supply all that we might reasonably desire under these heads? Towns, like individuals, make their own reputation. We can make or mar the reputation of the one in which we live.

The management of a city greatly resembles housekeeping, only on a larger scale, and those in whose hands it lies need to exercise a quick sense of order and cleanliness, talent for detail, and a respect for small things—for those trifles which, in the aggregate, make perfection or the reverse.

A good housekeeper, of course, first looks after the condition of her cellar, her refrigerator, the purity of water for cooking and drinking, and the freshness of meats and vegetables. This must be done, but without leaving undone other things of almost equal importance. So she proceeds to clean up and wages war against rats, mice, moth, mould, mildew, dust, and rubbish of every description. Eternal vigilance is the only price of liberty from all these pests. So her house smells as fresh has a rose, shines with cleanliness, and is sweet and wholesome, with a potent charm for all who are privileged to enter it. She began underground and worked upwards. And thus it is with a town.

By thorough drainage, absolutely pure water, and perfect ventilation of schools, churches and public halls, we can make it so healthful that the causes of nine-tenths of all illness shall be removed.

Why may we not combine to make the death-rate of Bozeman* the lowest not only in the United States but in the world? There

* What is said of Bozeman as an example, will apply to many other towns in the state.

is much to aid us in so doing. A fairly good climate, high altitude, possibility of pure water, and an open situation where all the winds of heaven can have full sweep, to supply it with fresh air.

This lowness of death-rate would in itself make it an ideal resort, not only for invalids but for well people who want to keep well, and to bring up their children among healthful surroundings. The effect of this upon real estate may be imagined.

Now let us count our other blessings. A good town library is not the least among them; its books wonderfully well chosen and forming an admirable nucleus for further growth. Our educational advantages naturally attract the many who appreciate the privileges afforded by a college town.

We have endurable summer weather. Eastern people who broil in July and August would be thankful for a place where they could sleep at night and be comfortable by day.

Why should not Bozeman and other Montana towns be as popular in summer as are Los Angeles and Santa Barbara in the winter months? But towns like people need an attractive exterior.

Of course, cleanliness comes first in the list of city virtues. The example of the town of Broek shows what a world-wide reputation can be gained by mere cleanliness.

Perfect drainage is the first requisite, but surface cleanliness must go with it. Can we not begin that at once, and go deeper so soon as our funds will permit? Can we not organize such a branch of work this evening?

We see dirt, saliva, rags, paper, peanut shells, orange peel, tin cans, broken glass and rubbish of every description on every street. Alleyways, back yards, and unbuilt lots are encumbered with debris. No woman could sleep a wink if she had anything like it in her own house. Then why endure it outside?

We have many lessons to learn from our neighbors over the water. Spitting seems unknown in foreign towns. In Paris the sergeant de ville invades your privacy and scolds you roundly if an orange peel or a bit of paper by accident falls out of the window—not that European towns are perfect. Along with surface cleanliness there is often dreadful neglect of drainage. But Americans ought to be sufficiently advanced to cultivate all their virtues and our own into the bargain. Now there is nothing unpractical or visionary about all this.

Cleanliness, healthfulness and beauty pay. It would absolutely pay to engage some competent landscape gardener to come out here and take this town in hand. Not to clean it up, for that we can do ourselves, but his trained, artistic eye would at once perceive all the natural advantages of the town and he would know how to grasp and to make the most of them to the lasting improvement of the place and great benefit to the pockets of property owners.

Many of you are familiar with some of the charming eastern towns, such as old Windsor, Springfield, Fairfield, Lenox and others too numerous to mention, with their lovely trees, their exquisitely kept door yards and their broad, well paved and well kept streets. Sidewalks in perfect order, bordered by grass between them and the roadway, the turf as carefully clipped as on any fine lawn. Not an atom of rubbish to be seen, not a weed allowed to crop up, and unbuilt lots cared for and kept in order by the whole population. Would you not like to transport such a town to this lovely valley and set it down here among your own beautiful mountains?

Travellers to the western coast would stop here to see it, and tourists to the Yellowstone Park would extend their pilgrimage to visit the cleanest and prettiest town in America. Might we not discover that manufactures and other business enterprises were not absolutely necessary to secure the financial success of the towns?

All we need do now is to begin. Let us have the faith of the small boy, who knows that when he has once set his snow ball to rolling it is sure to grow larger and larger, at every turn. This society once in earnest, can mould public sentiment, and hearty encouragement, and many gifts will come in, even sooner than you expect them. Of course, it takes hard work and individual energy to move people,—inertia being one of the great forces of nature. Hard work comes first, an admiring public comes later—but it will come, and call you blessed.

If I could afford it, I would buy up one of these beautiful canons and somewhere in it build such a log house as half New York would make a pilgrimage to see. Bear and panther and buffalo heads should be carved upon its great beams. It should be so placed that it would command a magnificent prospect and its surroundings should be made to agree with it. Its wide, deep

hall should have a glorious great fireplace, broad windows, and square bays from which one could see three ways at once, should command the view on all sides. One should not be obliged to dodge heavy millions, and peep around corners to catch broken glimpses of the prospect. And there I would cultivate the native trees and plants and those capable of being acclimated there—a sort of extension of our present agricultural work. The birds should be cultivated along with them. And there would I entertain right royally, having in imagination, already selected the parties of friends who should be invited to enjoy it.

Among our proposed improvements let us not forget the beauty of judicious planting of trees and shrubs. We all know how grateful we feel for the shade of trees after having travelled in a hot sun, and how much their presence adds to the beauty of the landscape.

Some towns are planted to death, often to the obstruction of the finest views. But all dwellers in this part of the world seem gifted with a quick sense of the beauty of their mountains. They may, therefore, safely be trusted to plant with judgment and are less likely than in most communities to be afflicted by committees who have more zeal than knowledge.

This society has been accused of merely dreaming dreams and seeing visions. While we are already beginning to put our ideas into practice there is no doubt, an element of truth in the accusation. In the nature of things all the good and great work of the world must first be a work of the imagination. It must be thought out before it can be wrought out. But it is equally true that the dreams of one generation become the accomplished facts of the next.

FLOWERS FOR HOME AND GARDEN.

By C. F. Dallman, Missoula, Montana.

To have a beautiful flower garden, one must take pleasure in working, and caring for the plants when young, for picking the flowers is by no means the only labor attached to a flower garden. Nothing will brighten the surrounding of a home more than a well arranged and well cared for flower garden.

With the large and varied selection of plants and seeds which flourish well in our climate, there is no reason why every home should not have a flower garden. Begin your preparation in the fall of the year, by planting out some Tulips, Hyacinths, or other bulbs; these will be ready to come out by the first sign of spring, and can be had for early spring blooming, the same ground to be followed with other plants for summer and fall flowers.

The best soil adapted for flowering plants, generally, is a light friable loam, containing a sufficient amount of sand to render it porous. A great many varieties will live in almost any soil, except it be extremely dry, or of a stiff heavy character; still to give them a fair chance for development some little pains should be taken in adding to the soil some fertilizer. Deep digging and enriching with thoroughly decayed manure, is the least, that should be done. If the weather after sowing should be dry, it will be necessary to water the places where the seeds are sown, with a fine hose or watering can, regularly, but lightly every evening, as it is essential that the seeds, during their process of germination should be kept continually moist. From neglect, or oversight, arises most of the failure, for the process of germination is shorter, or longer in the different kinds of seeds. The patience of the cultivator, is sorely tried, with seeds of a slowly germinating character. The patience of a devoted florist, however, is never exhausted in these manipulations, and the certainty of his final success repays him fully for the little trouble.

In sowing your seeds, care should be taken by sowing them the proper depth, cover small seeds lightly, and the larger seeds deeper, very small seeds should be merely sprinkled on the surface of the ground, and afterwards protected from the scorching sun and heavy rains. The varieties are so plentiful that a detailed description, would take up the entire time of this meeting; sufficient to say is, that if you are interested in what to sow or plant, send to your nearest Florist he will help you out and no doubt will sell you what is best adapted for your wants.

Plants for Home and Windows.

Nearly every one can have a window garden, or house plants, provided the house is sufficiently heated, to prevent the temperature going near the freezing point. As many of you have furnaces, and most all have ample means of keeping their houses from freezing, it is therefore within the reach of all, to enjoy the beauties and benefits from a well kept Window Garden. A bay window with a south exposure is the best, and the next best is an east window. In both cases a goodly amount of sun can be obtained and more light, than from any other side of the house, and this is better for blooming and flowering plants. The west and north windows, are better adapted for foliage plants, such as, Ferns, Palms, Fuchsias and others, as these do not require the direct sun and bright light.

Each flower lover must decide for himself how many plants he wishes to keep, and just how to arrange them. Frequently shelves can be put in a bay window for supporting the pots, but do not set them too close to the glass. A better plan perhaps, is to have a series of shelves arranged on a stand which can be moved back and forth, as necessity demands. Do not have too many plants; in the first place they require too much care, and in the second place are not apt to remain healthy.

Plants in a living room require plenty of fresh air, but as this is also essential for the family it should be no draw back. Some arrangement must be made to have plenty of ventilation, and supplying moisture, as the air of the living room is frequently too dry for plants. The moisture can be supplied by keeping a vessel of water on the stove, and by giving the plants a bath about once a week, by sprinkling or washing them with slightly warm water. This not only supplies moisture but removed the dust, and allows the plant to do the proper amount of breathing. Most plants will die in a dry atmosphere. This explains the fact that there is very little difficulty in raising plants in the kitchen, while in the living rooms, there is more or less trouble in succeeding well. Turn the plants, about once a week, so that they will develop systematically, if this is not done, they will grow to one side. Give all the light possible during the winter and allow the curtains to be drawn, the plants will be sufficiently beautiful for any window.

If you are intending to do your own propogating, which, in

itself is a very interesting process, and a good study for your children, prepare a box or pan with moist sand, in which most of the cuttings, such as Geraniums, Fuchsias, Heliotrope, Carnations and many other soft wooded varieties, will take root in ten to twenty days, if kept continually moist and near the light.

When the cuttings are showing new leaves is the proper time to plant in well prepared soil, in small pots. Care should be taken to have good drainage in the pots, to prevent the soil from getting sour. If any insect-pests are troubling your plants remedies should be applied. One of the worst of these pests is the red spider. The most effecting way to keep this in check is to drench the plant with water, keeping the leaves moist and the atmosphere full of water. The red spider cannot stand this treatment. Plant lice or aphids are also very troublesome, but easily kept in check by sprinkling with tobacco water; soapsuds are also very effective.

Thus with a little care every home might be made cheerful and homelike by a well kept, window or flower garden.

HOW TO KEEP THE BOYS AND GIRLS ON THE FARM.

Mrs. D. S. Williams, Whitehall, Montana.

The successful, industrious farmer can well be proud of his vocation. The time is past when intelligent people refer to the farmer as a "hayseed." There are several reasons why this is true, but among others it is because the farmer is rapidly making himself worthy of his vocation. It was thought too that if a man did not have intelligence he could at least be a farmer, but usually such people turn out to be what we might properly call "hayseeds." I think you will agree with me when I say that other qualities being equal the most intelligent farmer is the most successful one. The subject of the discussion is a practical one and is worthy of great consideration as it certainly baffles the parent, "How can we keep the boys and girls on the farm?" I answer, "by making them believe that it is the best place in the world for them to be." This answer is brief, but it needs amplification. Now let us consider why it is the best place. It is true that there is considerable hard work, but at the same time it is not all drudgery, or at least there is no need of its being so. Every occupation has its unpleasant features but there is no occu-

pation where the individual is more independent than in farming, and independence is something which we all crave for. In more senses than one he is "Lord of all he surveys." In Montana and it seems to me, particularly in this section of Montana so near the large cities, there is good profit in agriculture, and it should not take long for the young man, who is willing to work, to get a reasonable start, for the land is yet cheap and productive, and will yield large returns. In the eastern and central states where the price of land is so high, it is practically impossible for a young man without capital to get a farm. Even if he does purchase a farm he will be unable to realize enough profits to make it possible for him to reduce the mortgage very much. This is not the condition in Montana yet, so the young man can hardly give this for a reason. Neither can it be said that it is not a profitable enterprise, and certainly manual labor is honorable. I believe that the young men will find, if they investigate, that on a general average for a whole year the farmer has more hours of rest and leisure than most men of other vocations.

Again the home on the farm should be made the happiest place possible. The girls and boys should be entertained at home. They should have games, books, newspapers, and magazines.

They should have the privilege of visiting during the long winter evenings at their neighbors so that all their pleasures will center at their homes. Make their home life joyous. Have them take pride in their homes and make them such that they need not be ashamed of. As soon as you are able, furnish the home so that it will be homelike and attractive, and this time should come before you have built all your fine barns and out-buildings.

Encourage the girls to make the home attractive, regardless of how humble the home may be. Let her exercise her ingenuity in planning and executing. The boys and girls should be able to speak of "our home" with pride.

The lawn, flowers, trees, shrubbery, all these require attention, and tend to make the home interesting and attractive, and every home so fitted up means that more will have these attractions. Cultivate any desire or talent for music in the home. They may not become Prima Donnas of the art, but what unites parent and children and love of home better than an evening spent around the cheerful fireside with singing, music and a social chat.

Teach your girls to cook and let them experiment along these lines. Some mothers think their daughters can wash dishes or dust, etc., but are not competent to make a pie or cake or bake the roast for dinner, but we learn by doing and they will never be able to do these well unless they are allowed to practice. What if they do have failures and possibly spoil the dinner a few times, do not discourage them but rather encourage for "Practice makes perfect." Many a mother speaks with pride of the fact that her daughter never works in the kitchen. What is reasonable for the mother to do is good enough for the daughter and that mother does her daughter an irreparable wrong. There is something terribly wrong when a daughter seeks pleasure while her mother toils for her welfare, and I know of no place for such girls. I know of one excellent mother who trained a large family of girls in a most charming way. When the girls had attained the age of fourteen they were responsible for the making of dinner one day each week. Give them a fair chance. If they have not been made to do all the little unpleasant tasks housework will not be unpleasant and they will not look for other work. While if the young lady is eighteen, when she begins this work, she of course, gets discouraged at the failures she makes, and why shouldn't she. Too many parents are so eager to better the conditions of their children, that they in reality are too often to blame for the child's dissatisfaction on the farm. Now to return to the boy. The affectionate mother has frequently expressed her hope that "her boy" will find an easier livelihood than his father before him, so he may be sent to take a short course in medicine, law or theology, and soon begins to practice. Having been supported liberally by his parents during his college days he learns only as much as he has to and you can imagine what kind of a practitioner he makes.

We need more good farmers, instead of more poor doctors, poor lawyers, and poor ministers. There are a thousand questions of interest to the wide awake intelligent farmer's boy, the whole realm of Physics, Chemistry, Zoology, and Biology and Plant Physiology is before him. I wonder how many of the young men of the locality know that alfalfa has any value excepting as food. If it has, what is it? What other forage plants possess the same qualities? The farm should be a great laboratory where the boy can solve a host of original problems for

himself. Farming is no longer mere drudgery. The enterprising farmer is always solving some problem. Questions concerning cost of production, relative gains, etc. It is not the man who works hardest always, that makes the most money on the farm. You have known cases where the parties are constantly working but are never ahead. The man who thinks the most logically, understands the materials which he employs and knows how to apply these principles and practices common sense makes the most money. How keep the boys on the farm? Make the work interesting. How can it be done? Educate him to the life with which he comes in contact. So if the boy has finished the eighth grade or better still the High School, and then is given an opportunity to attend the Agricultural College, he is then in condition to enjoy life on the farm. This may seem more than the parents may feel that they can do for the boys, but boys are willing to make many sacrifices if they are offered these advantages. He is no longer simply a farmer but as Emerson says, he is "man thinking" on the farm. He no longer notices the drudgery because he has risen above it. Where does the young man get the idea that farm work is drudgery? It indicates that the work which he has been made to do was just routine work. Too frequently the parents plod along unceasingly without any interest in the work other than the dollars which can be made. There is more in life on the farm than that, surrounded as man is by all forms of life. The better a man is educated the more numerous are his pleasures in work because he better understands the elements and forces with which he works and can adapt himself so as to secure the very best results.

THE IMPROVEMENT OF THE FARMERS' SCHOOLS.*

By Prof. O. J. Bright, Chicago, Illinois.

This great State of ours is constantly exploited from the platform in many respects, not only as to the richness of its soil, its varied productions, its countless manufactures, its great wealth and greater possibilities of wealth, but also as to its great men who have been so prominent in our national history. Of all its productions, however, to my mind the most important is its girls and boys. In the public schools of Illinois there have been in attendance today not far from 1,000,000 children. And this is an amazing thought. If you should place them in single file beginning at the Mississippi river and far enough apart so that they would not be fooling with each other in the march, at the time that the first one that past you in Joliet had reached New York, the last would scarcely have left the river. Imagine such a procession wending its way to the schools of this State, and then recall that half of these children are in our farm schools. Half of the teachers in Illinois are engaged in teaching boys and girls that live upon the farms, and this makes the problem of the country schools an exceedingly important one. The man who can do one thing which in any way brings about the betterment of these country schools, renders a patriotic service that he may well be proud of. Many splendid things have been said about these schools and their improvement, at this institute, and I need not go over the same topics the second time, but I propose tonight to illustrate to you some of the things which have already been said and also to suggest means of improvement of the rural schools which have not thus far been suggested.

This great State of ours, 350 miles from north to south and 250 miles from east to west, is a State that we are all proud of. But I must say to you, my friends, in all sincerity, that when it comes to modern, up-to-date school legislation, the State of Illinois is a back number. As compared with Wisconsin, Minnesota, Michigan, Indiana or Kansas, so far as legislation is concerned, it is twenty-years behind the times.

I have worked in almost every kind of public school that can be found in this country, but my keenest sympathies and special interest, have been with the country school all of my years of service since I began boarding around in a country school district forty-five years ago last November. For eleven years, ending

* Address delivered before the Illinois Farmers' Institute at Joliet, Illinois, and reported in 10th Annual Report Illinois Farmers' Institute.

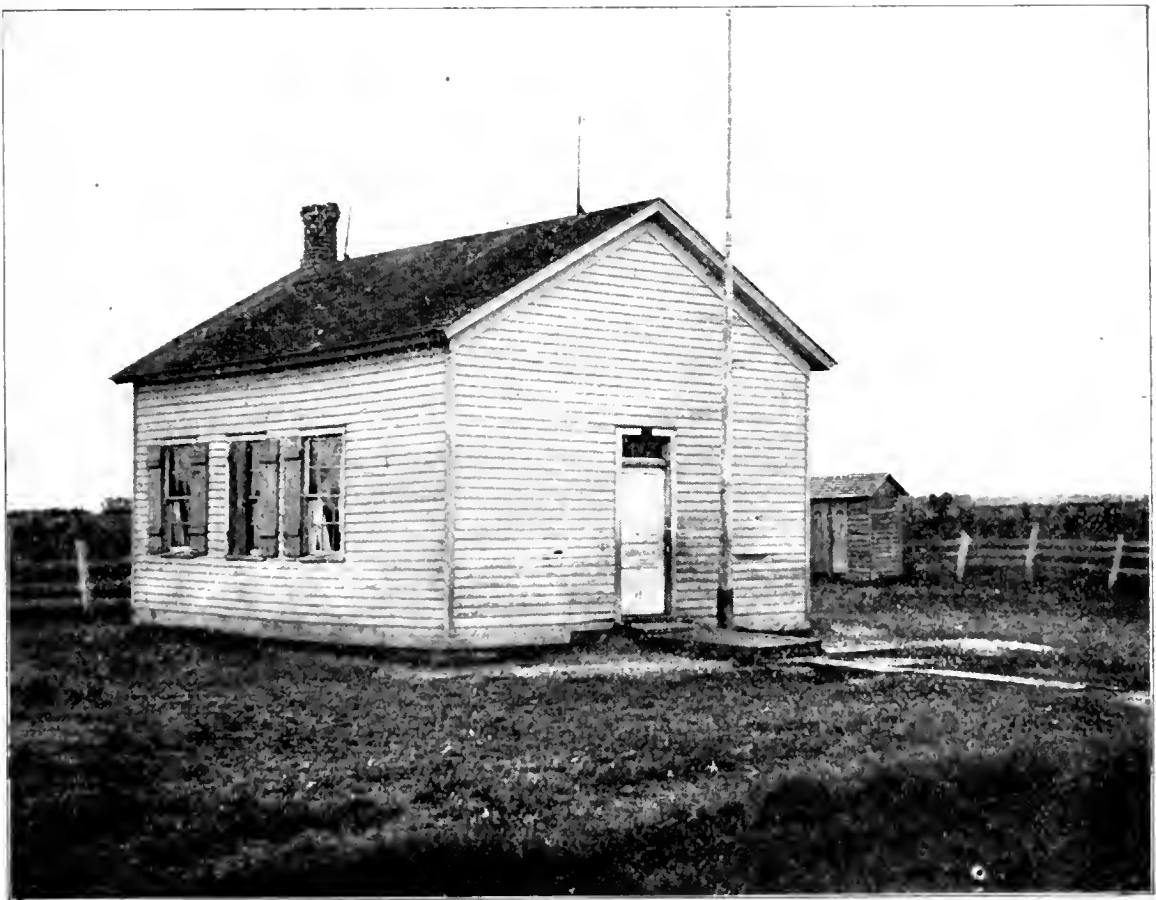
two years ago, I had charge of the schools of Cook county. The people in Joliet certainly know that Cook county is not all in the city of Chicago. There are 800 square miles not in the city limits and every one of the marks on the map which is before you represents a country school. Just such country schools as you have in Will county or in any other county of the State of Illinois. Of the 800 teachers under my supervision in Cook county, 150 were in the country schools. These schools are supported by farmers, and, so far as material surroundings are concerned, are like rural schools 100 miles from the great city of Chicago. There is one thing that I never failed to do in each of the eleven years that I was superintendent of Cook county—that was to drive my horse to each one of these 135 country schools at least once during the year. I have also worked in many other counties of the State, in teachers' institutes, and thus have kept in close touch with the farm schools not only in my own county, but in other parts of the State. I mention these things only to satisfy you of the credibility of the witness.

It is safe to say that there will be no revolution in the country schools of this State. Whatever improvement comes will come slowly, and perhaps this is well. I have, however, an abiding faith that some of the great measures which have made progress possible in neighboring states will come to Illinois sooner or later, although the vexatious delays caused by timid, scheming politicians who infest the legislature, are often very discouraging.

The first part of my lecture will have to do with conditions of which Mr. Harvey spoke so eloquently last night. I believe you will see many of his propositions more intensely after I get through, because there will be a massing of evidence by means of pictures which I shall show you upon the screen. There will be no sort of school house which you have not seen. There will be none so poor that you can not recall some like it in your own county, because, and I am sorry to say it, poor school houses are much more in evidence than good ones, in the school districts of Illinois. As I said before, there will be a massing of evidence and oftentimes the stereopticon picture impresses the beholder even more than the real thing.

I shall show you only types of our rural schools, and they are types of things which are perpetuated only because of tradition—that is, we build this style of school house simply because our

fathers and grand fathers built them. There is not an element of beauty in the building and nothing in the world to commend it except that it is a shelter. The trees which adorn this school premises are like those provided for nine out of ten farm schools the country over. This house has been standing for forty-five or fifty years within an hour's drive of the city limits of Chicago. A decade in a thing of this kind makes but slight difference and it makes no difference at all in the trees and other plants. As a type or style of architecture, the house shown upon the screen is the prevailing thing from one end of the United States to the other. I refer, of course, to its shape, which is exactly like a dry goods box with a roof over it.



Study the picture and see whether the description fits the object. There is just as much exercise of the gray matter of the brain in planning that sort of a thing as there is in planning a dog-kennel and no more. There is nobody present in this audience who has not seen hundreds of them. More than 50 per cent, yes, 75 per cent of the country schools in Cook county are

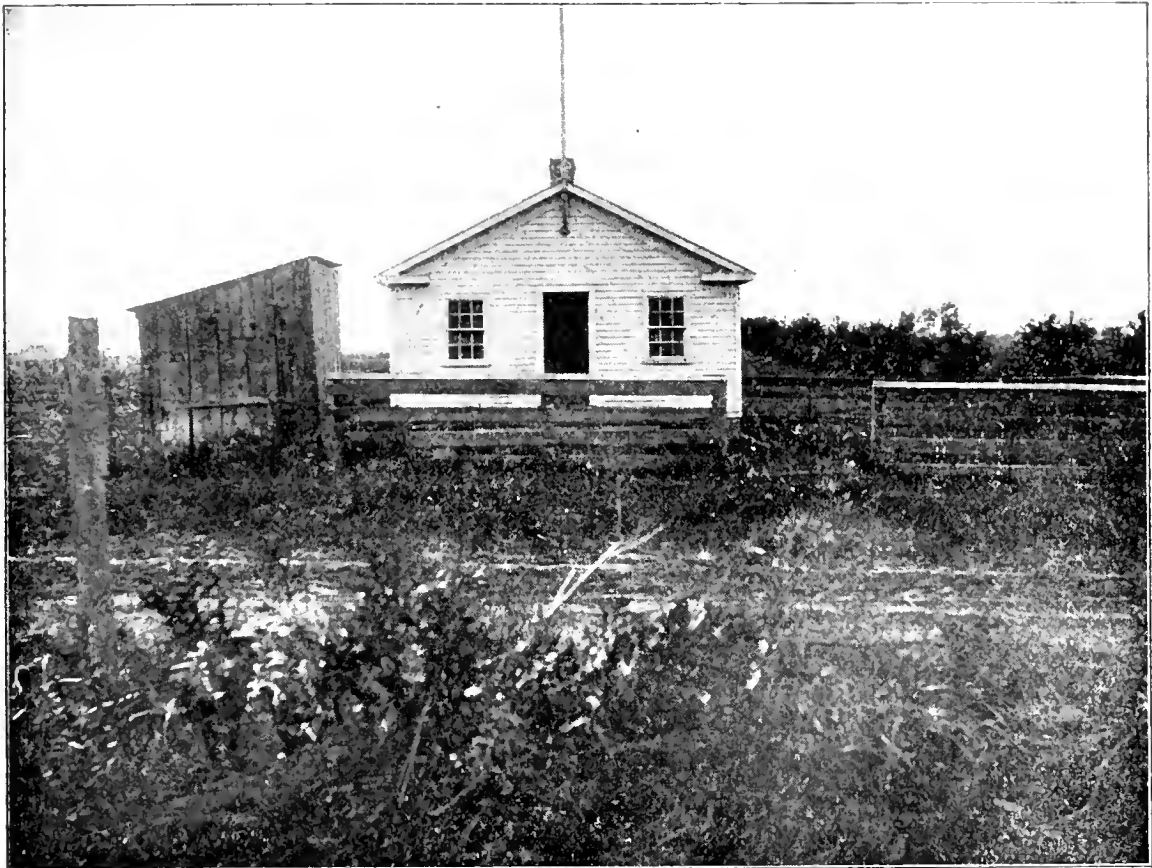
of that pattern, so far as architecture is concerned. There is a little variation, here and there, as you see in the picture which follows, and I wish to assure you that you are looking at the front end of this school house. It would seem as if this shed was placed on the front for the express purpose of adding to its ugliness. The children enter the school house through the shed every morning in thirty or forty school houses in Cook county and I entered it once a year in each of eleven years. The wood, the coal, the ash pail, the dust pan, the broom, the water pail, soap dish, wash basin (if they have one) and any old thing that is not wanted



elsewhere, is in evidence as one enters the school house. What a pleasant reception each morning for the girls and boys from the farms who come to such a place to get their education. I contend that it is a ridiculous travesty on what we call patriotism, to set up a flag pole and fly the stars and stripes over a concern like that which stands for all of the public education given to boys and girls in thousands and thousands of districts in every state in the United States. The training of children to "holler" for the

flag and sing songs to it under such conditions is a hollow mockery.

Here is another type, not in the shape of the school house, but in the general arrangement of buildings. The coal shed, the one outbuilding and the school house are bunched right together on the street and any farmer here knows where to go to find this lay



out. The school house is about 14x18 feet and you see all of the buildings on the lot. I ask this question—how anything in the way of decency and modesty can be taught to children under such conditions as are provided by the farmers who send their children to such schools. There can be no excuse for such a thing in any district, and much less in a wealthy one such as these premises represent.

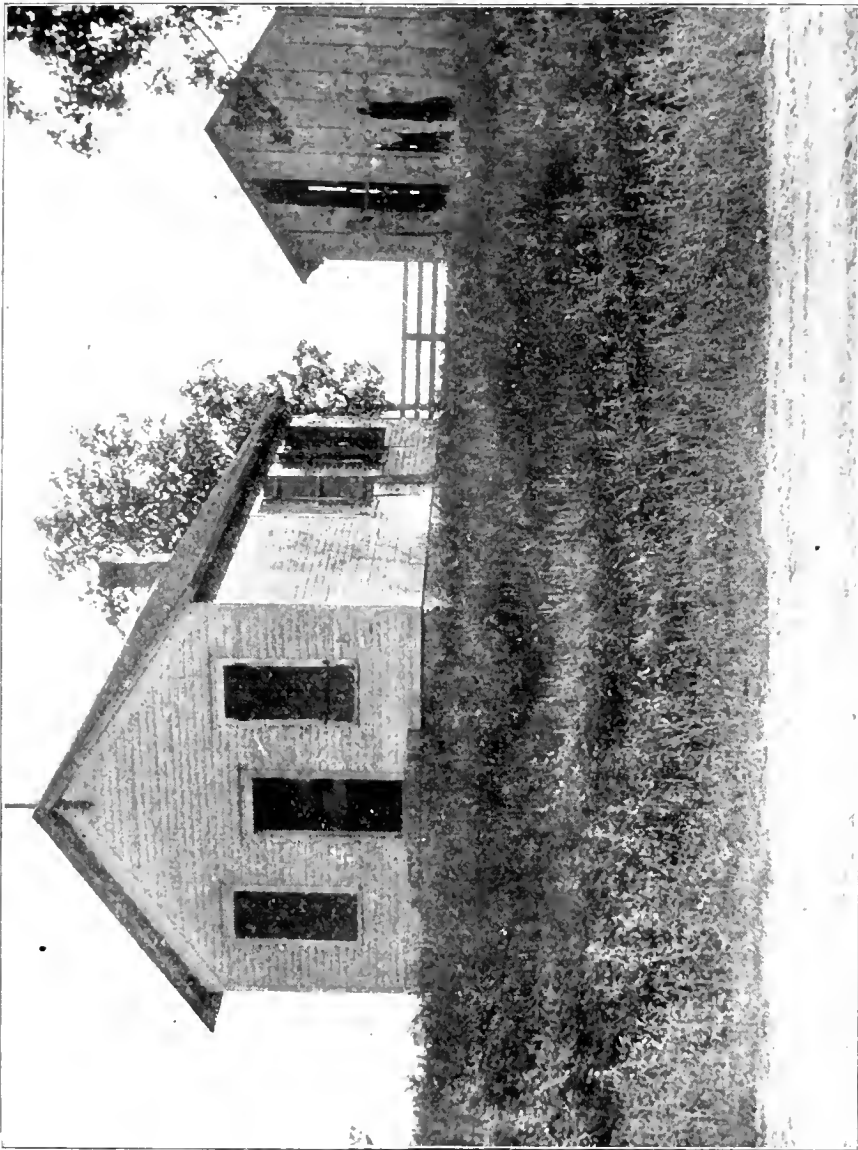
In almost any county in Illinois one may find many beautiful farm homes which, though they may be plain, simple and modest, show in themselves and their surroundings that some one with good taste lives in them—that somebody cares.

This home indicates that some one selected a site alongside of that group of fine oak trees, thinking, perhaps, it would be a good place for children to play. The same sentiment might dictate the choice of school sites, and why should not trees be alongside of the school house? I can not answer the question. It is one of the amazing things in American educational matters, that our country school premises are so barren, and God-forsaken. We find thousands of up-to-date barns in all parts of the State and

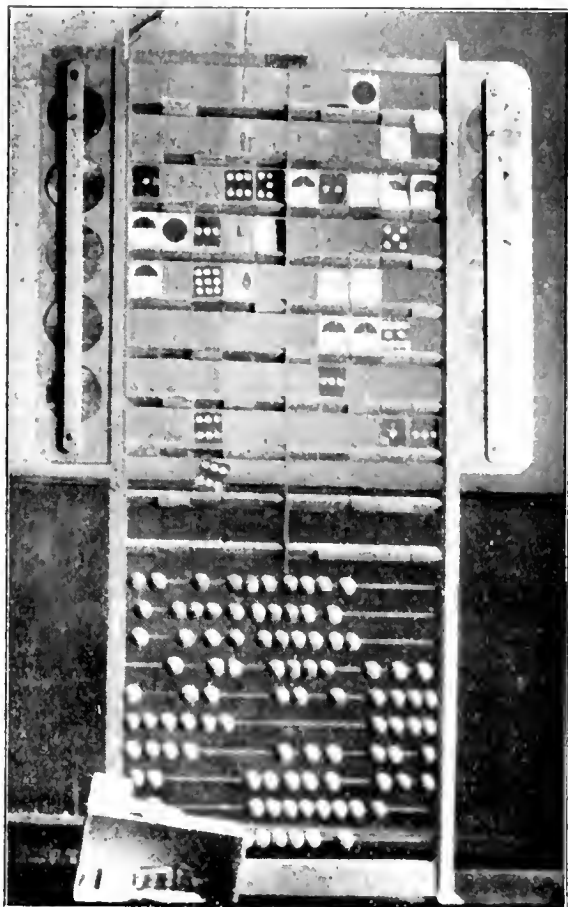


wherever stock is to be cared for in these barns by progressive farmers we find them well ventilated, and this because they are provided for horses and cattle. But when it comes to school houses, where the children of these same farmers attend school, there is no ventilation whatever in the construction of the school house; and this, I imagine, because only boys and girls are cared for in these school houses, and in boys and girls there is no immediate return in dollars. In other words—we don't sell them. In many cases, like this, the ventilation is all given to the coal shed. This particular school house has recently gone out of business, but for fifty years it was all that a wealthy district furnished for from forty to sixty children each year, and that within three miles of the city of Elgin. The school house stands on one-tenth of an acre of land and when it was built the land was not worth more than \$29.00 an acre. In place of these school premises, a comfortable building has now been provided in a beautiful grove containing one acre of land. I believe that the change has been

brought about as a result of publishing the picture at which you are now looking.



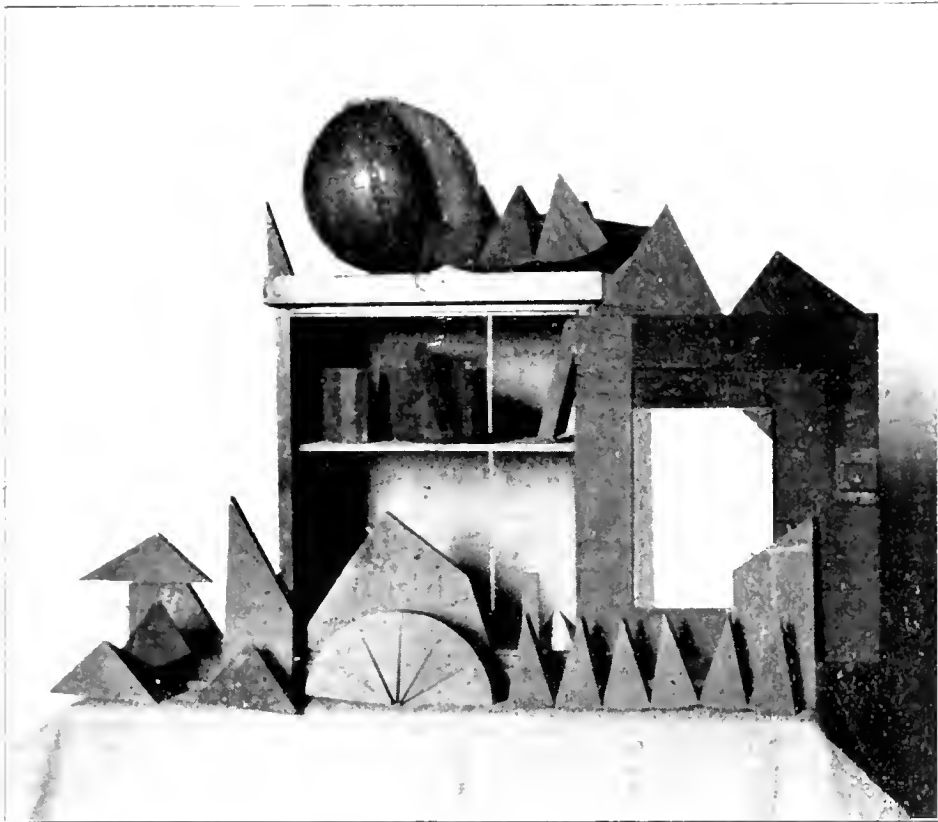
No. We do not have trees around our country school houses and the farmers are very loath to buy books which the teachers ask for and which are necessary in the teaching of their children. If the children are to be taught to read intelligently and quickly, there must be a good deal of reading matter for each year and especially for little children. Two years in a single reading book is a cruelty and it is the worst kind of economy. The farm-



ers will not buy the supplementary reading books but they will buy things like this, and there is scarcely a country school in Illinois that has not indulged in this sort of wastefulness.

It is called school apparatus and is sold by traveling agents. It consists mostly of charts, but there are concerns of one form or another for teaching numbers. Enough money has been put into this so-called apparatus by the country school boards of Illinois to supply every school in the State with a good useful library and also to furnish a fair amount of supplementary reading books for the children. Most of the stuff bought by the directors is good for nothing, absolutely; it is rubbish which the teachers do not want. These so-called geometrical solids can be found in

thousands of the country schools of Illinois at from twenty-eight to forty dollars a set, paid for from the taxes.



I show you a single page from a chart containing fifty or sixty pages of similar stuff and which was sold for from thirty-five to forty-five dollars according to the gullibility of the directors. It was supposed to be a combination of all of the studies in a country school. I presume you have all heard more or less of the "correlation of studies" in modern teaching. This pages may represent something of the sort as you will see by the title "Rules for Spelling and Political Economy." Just think what \$37.50, paid for this useless thing from the school tax, might have done for the children if put into the right kind of books. Charts, may be very useful, but they will be such charts as are made by the teachers and the apparatus for making them with material for a year's use will cost only two or three dollars.

RULES FOR SPELLING AND POLITICAL ECONOMY.

A PRIMITIVE WORD
Is a word without a prefix or suffix.
Example: A, at, hand, camp, etc.

A PREFIX
Is a syllable added to a word or syllable.
Example: The syllable "un" in "unhappy".
Prefixes are: un-, in-, im-, sub-, super-, etc.

A SUFFIX
Is a syllable added to the end of a word.
Example: The syllable "ly" in "happily".
Suffixes are: -ly, -ness, -lyness, -ness, -ness, etc.

STYLAR SOCIETY

NATURALITY

LABOR

FACTORS

CLASSES

UNSATISFACTION

CONDICTIONS

AGRICULTURAL ECONOMY.
Science and Art of Improving Agriculture.

FACTORS

CLASSES

UNSATISFACTION

CONDICTIONS

TRANSFORMATIONS

LEAVES.

How pretty the leaves
are.
They are not green now.
I have some maple leaves
and some oak leaves.
My maple leaves are
red and yellow.
The oak leaves are red
and brown.

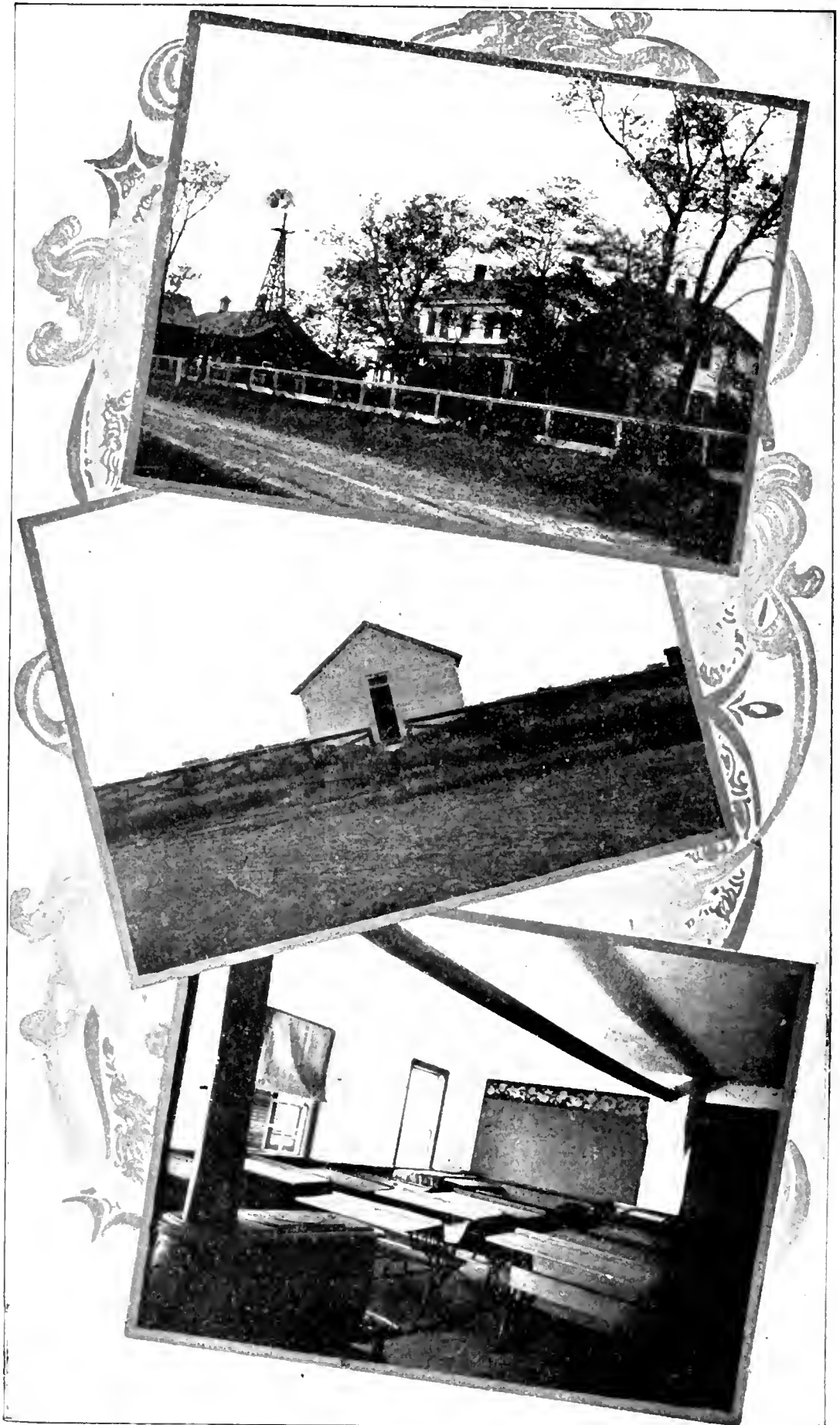
Note the reading lesson produced by a country school teacher who had taken her training in Colonel Parker's school. Such reading lessons as that are made to fit the topics which may be profitably studied in the country, suggested by the trees, the

flowers and the birds.

As another type of school house of different material, notice this. There are plenty of forest trees near at hand, but they have all been carefully cleared from the school yard. You will note that there are windows on four sides of this house. There is no entry way, and the black board was about as large as an old

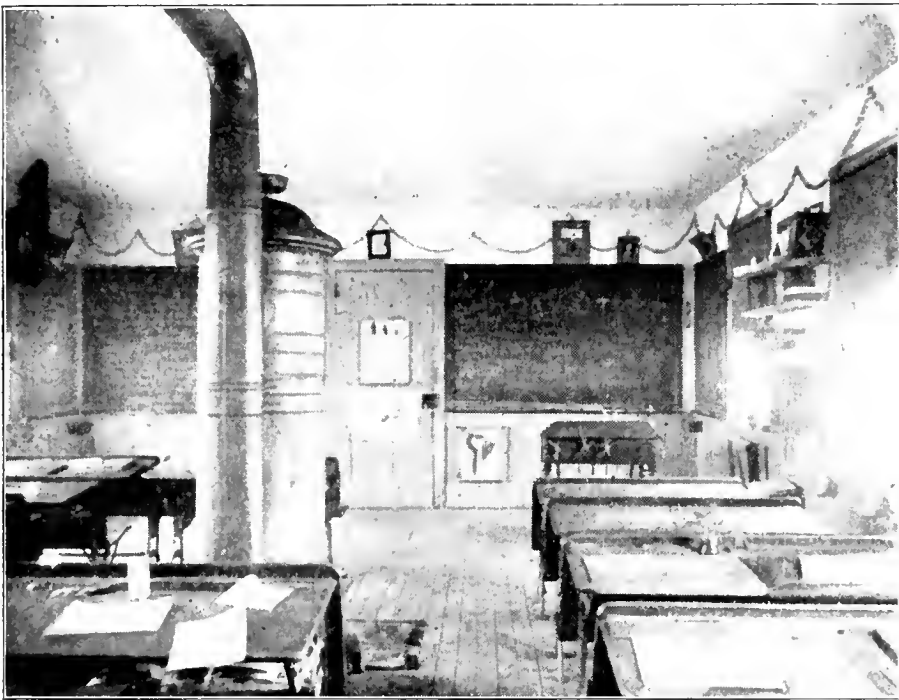


fashioned handkerchief. I visited this school one cold day and found the air in the room stifling. I suggested opening a window, but found that storm sash had been tightly fitted and that the only provision for ventilation for a school of twenty or twenty-five children was two inch auger holes in each sash, and then for fear there might be too much fresh air, a little trap door had been made to fit over these auger holes. The sash had been painted with the trap doors closed and they had stuck fast and the whole school house was pretty nearly air tight. The only possible ventilation was by opening the front door. Of course this sort of thing is the result of ignorance. The director who supplied the storm sash supposed he was doing a fine thing, but he did his job without consultation with anyone who knew. How much of disease and death comes to the children who at-



ted country schools, through lack of knowledge of the ordinary laws of health, nobody can begin to estimate.

To illustrate this a little farther with a striking contrast between a home and a school house in the same district. Everything about this home shows good taste, thrift and care, hard work saving. The old father of the present owner got his deed from the government, and the home is within a two hours drive of the city limits of the city of Chicago. Of course the first house has been replaced, but the third generation of children is now attending school in the school house which has never been replaced



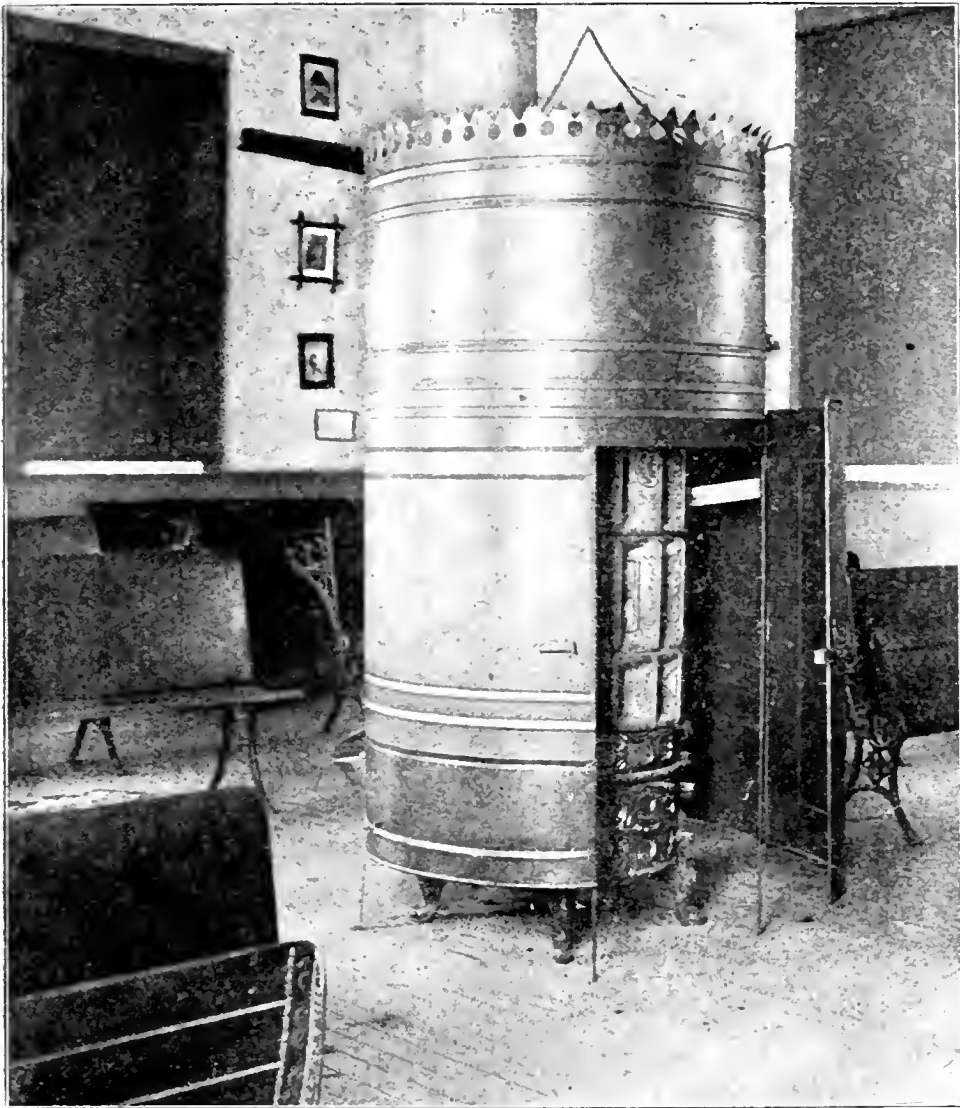
and is not likely to be and which is within two city blocks from the handsome farm home. The inside of the school house is quite in keeping with the outside. You see represented all of the seats except one row and this school house has as many as fifty children enrolled in a single winter, and that, year after year. You will note the stove of course, as it is the principal factor in the furniture of the school house, and this stove problem in country school houses is a very serious one. Heat it red hot in a cold day and the children near it are roasting while those who sit farthest away are freezing. Usually these stoves in country schools are placed in the center of the room and a large share of the room must be give up to them. Of course the center of the room is the best part of it. It is the part that should be most used. The

majority of country school rooms are fairly represented, so far as arrangement goes, by this picture. Now, if anything could be more wasteful or extravagant, than to give up a quarter or a third of the room in a school house to a stove, I should like to know what it is. This is done under the mistaken notion that the stove must be at the center of the room in order to heat it.



Here, again the mistake is made, because no thought is given to the subject. This stove was a heating terror, set between the teacher's desk and the desks of the children, which is a very common arrangement. After repeated requests that the room be properly arranged and the children protected from the stove, I finally offered to bear the expense of carrying out my suggestion if the results did not justify the change, and the directors consented. You will see at once from the picture what was asked for so far as the stove was concerned. After the jacket was provided the stove was moved back into a corner where it belonged and the whole school room became available for school purposes. The entire expense of such a jacket is \$6.00 or \$8.00 and the school room was not only sufficiently heated, but was evenly

heated in every part and one great danger to the health of the children was thereby removed. The children no longer suffered from cold feet and hot heads. Here is a chance for radical improvement in the cold school houses.



Note another contrast and another type.

A friend of mine has this beautiful little home which he occupies in the summer months. It is not in Cook county and is not in Illinois. So far as the home is concerned, the point to notice is the care in saving the trees. The trees are cared for because the man has children and because the home in which he is rearing them is so much pleasanter, so much healthier, so much more beautiful on account of the trees. Just eighty rods from this home is the school house of the district and it is a typical school house, rather extreme I will admit, but at the same time it is a

type. You will note that the trees, and they were many, have all been carefully removed from the school vicinity. The entire

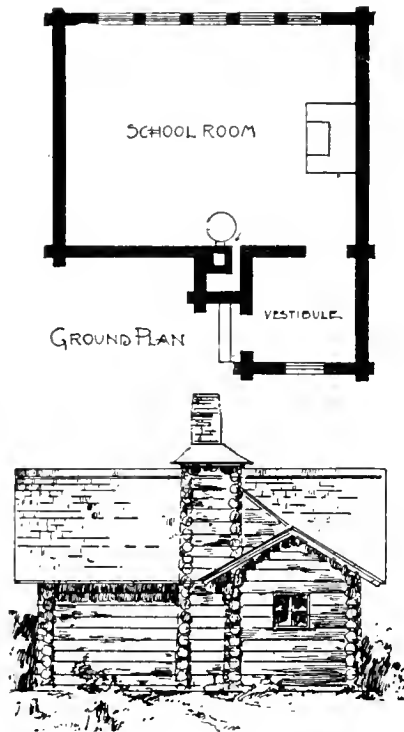


land owned as part of the school premises is covered by school house, every square foot of it. The only playground is the street. There is not a building of any kind other than the school house. The land in the vicinity is not worth \$20.00 an acre to-day. Is it not amazing that such a thing as this can be found



to-day in a western state? Think of the health conditions imposed; think also of the conditions under which these children are coming to manhood and womanhood, and think also what is

their notion of adequate educational provision in public schools, if such notion is learned in this school house. It is not because these people wish to impose damnable conditions upon their children, but it is because they do not think. In other words, "nobody cares."



You may have a log school house and have a beauty, provided that brains are used in the construction. A little action of the gray matter may bring about such a building as this that would be noted for its architectural taste. Note also the floor plan of the school with the stove, smoke flue and ventilator at the side and also that the smoke flue is made to cause effectiveness in the ventilator which is just alongside. Then if we should think to do some planting to enhance the beauty of this building as is often done with the farm home buildings in the district, see what it might become. How many of you have ever seen vines growing upon a school house; how many have ever seen flowers blossoming alongside? Why not, I should like to ask? These things make the home more beautiful; they would make the school more beautiful. The same children that come from beautiful homes come to desolate school houses and why should they? Vines like these cost nothing but a little care and in the exercise of this care the children would be getting a better education, provided they cultivated the plants about the school house.

Morning-glory and woodbine will grow almost anywhere, once well started, and the minimum of attention will keep them growing and make them thrifty. The exercise of care and the interest which makes growing plants healthful, develops character at the same time and that becomes beautiful as the plants become beautiful.



I insist upon it that the environment of the school house and its inside arrangement and decoration have vastly to do with the education of children. Beautiful surroundings at school will tend to beautiful surroundings at home. Tasteful arrangement of the school room, the tinting of the walls, the proper hanging of suitable pictures, all tend to an education that will sometime make beautiful and happy homes. A home must be something more than a shelter and a place in which to get food. It may be comfortable so far as freedom from bodily pain is concerned, but there is something else in the human being which must also have attention. Why have these trees? Because there is so much in them to teach and to interest. The opening of the buds in spring, their unfolding into leaves in the summer and in the fall the color that lends such beauty, and then the dropping of the leaves; and later in the winter, as you know, just about once a

year, Jack Frost gets in his work at night when the moisture in the air is just right. What a fairy scene is presented in the morning when all the bushes and twigs are covered with millions of shining crystals.

You can have all these things for the children if you have the trees, but not otherwise. Nature study does not detract from the studies which have held in the school for all the years past. The teacher that can take the children out among the trees to study the wonderful work of the Creator, will not detract from the



earnestness of the children in their ordinary lessons, but will add to it. This is the universal testimony. But if it were a little less of least common multiple, the greatest common divisor, or the capes and boundaries in Asia and Africa, and more of the study of things which are of immediate and continued interest around about where the children live, the education of these children would be vastly better than it is.

School houses are not all so forlorn and God-forsaken as those thus far shown, but the pretty school premises with trees, such as we see here, are the exception. This little building is very

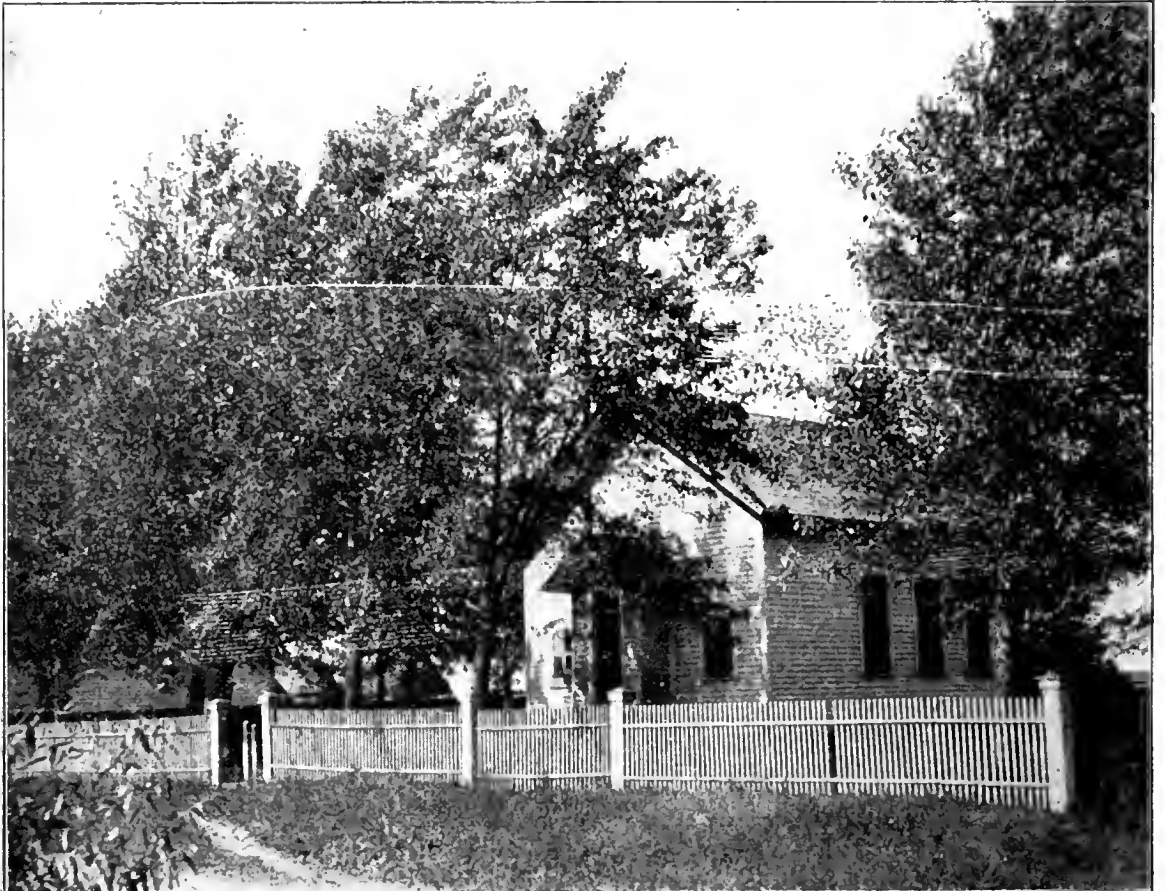
modest, but it is prettily surrounded and the whole effect is beautiful. I asked one of the directors:

"What did those trees cost?"

"I do not know what they cost."

"Did they all cost \$50.00."

"No."



"Did they cost \$15.00?"

"No."

"Well, do you think they cost \$5.00."

"Well, I don't know. They may have cost \$5.00. All there is of it, some of us got together one day a good many years ago and planted them."

"Would you take \$50.00 apiece for them Mr. Wilson?" He answered:

"I guess we will keep them."

Would you keep them if they were around the school house where your children go to school?

Do you suppose that children can go through this little avenue

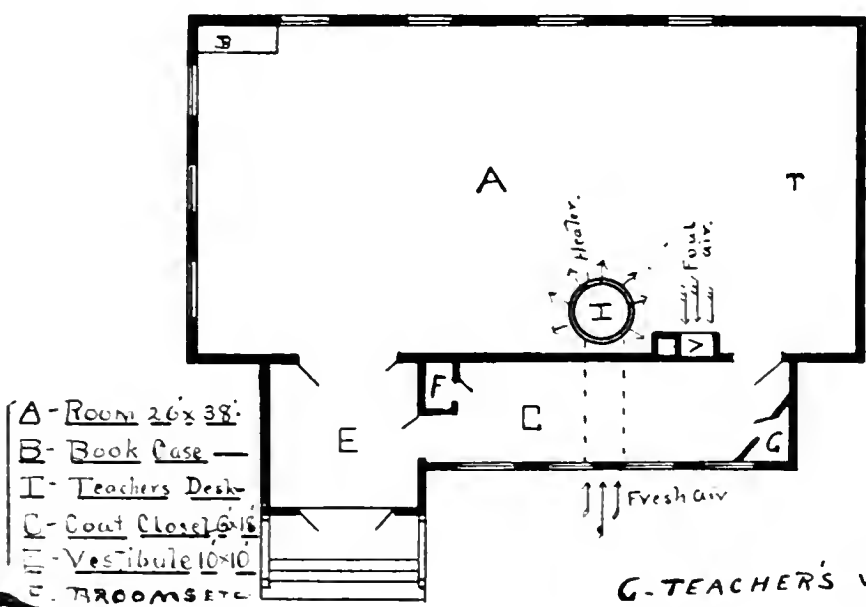
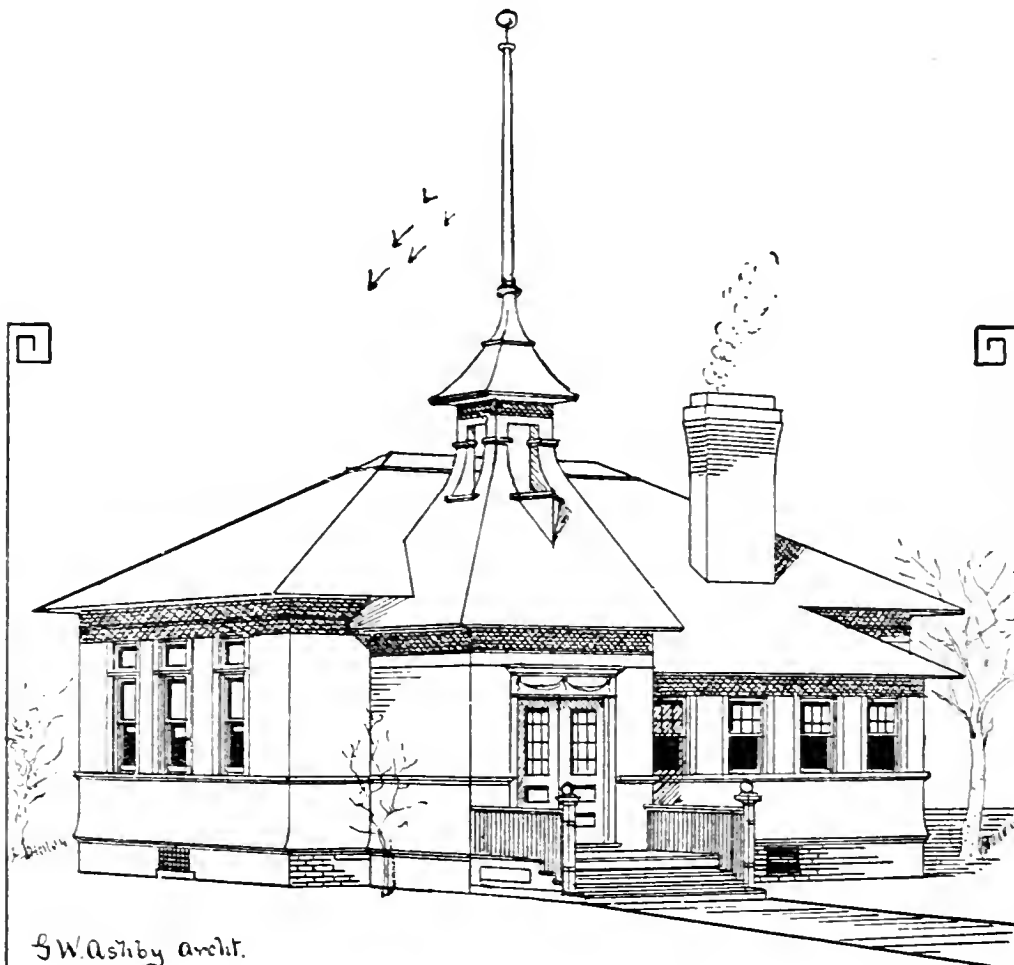
once a day during the school term for several years and not be the better for it?

This school is situated in a part of our country where the trees have come only from the planting, but someone thought to plant them and now the school yard is the greatest pride of every resident of the district. In all of the 135 country schools of Cook



county, however, one can count all of the yards of this kind or that approach it, on his fingers. The same is true of 75 per cent of the counties of Illinois.

There is no excuse whatever for the sameness which has prevailed in the making of country school houses. The only thing to compare with it that I know of, are the homes in factory towns. In a township with six or eight or ten country schools, there should be the same variety in architecture that one would find in an equal number of pleasant country homes. To illustrate what I mean, I ask your careful attention to the three pictures which follow and also to the floor plan of these school houses. They are all handsome buildings, but each is different from the other, as it should be. You will see how convenient school rooms can



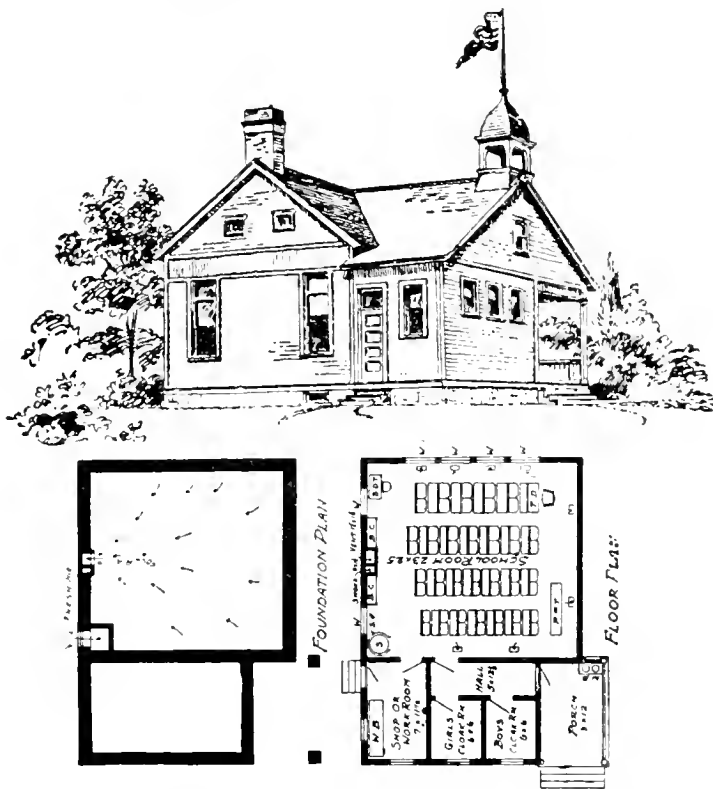
- A - Room 26 x 38
- B - Book Case
- I - Teachers Desk
- C - Coat Closet 6 x 16
- E - Vestibule 10 x 10
- G - ROOMS ETC

G - TEACHER'S WARDROBE

be made even in the country school houses. Note that the heater is always placed out of the way where it will be least in evidence and that the ventilator and smoke flue are near to the heater as they should be. Very many of our present school rooms can be so arranged at a slight expense and be made almost as effective as the plans which I am showing you.

As an interesting feature of three of these plans, I wish you to note the work room, that is a room in which is a bench with tools, this may seem a great innovation but it is an excellent one, for

MISSOURI'S MODEL RURAL SCHOOL BUILDING.



what better thing can a young farmer learn than how to use tools effectively? Note that the smoke flue and ventilator are always in conjunction. The reason for this, I think, will be evident to you, that the waste heat of the smoke flue shall cause the draft of foul air from the room, so that you see the ventilator is made effective without any additional expense. This sort of thing is brought about by thinking, and if a reasonable amount of thought had been given to our country school construction, the proper heating and ventilating would be the rule rather than the exception.

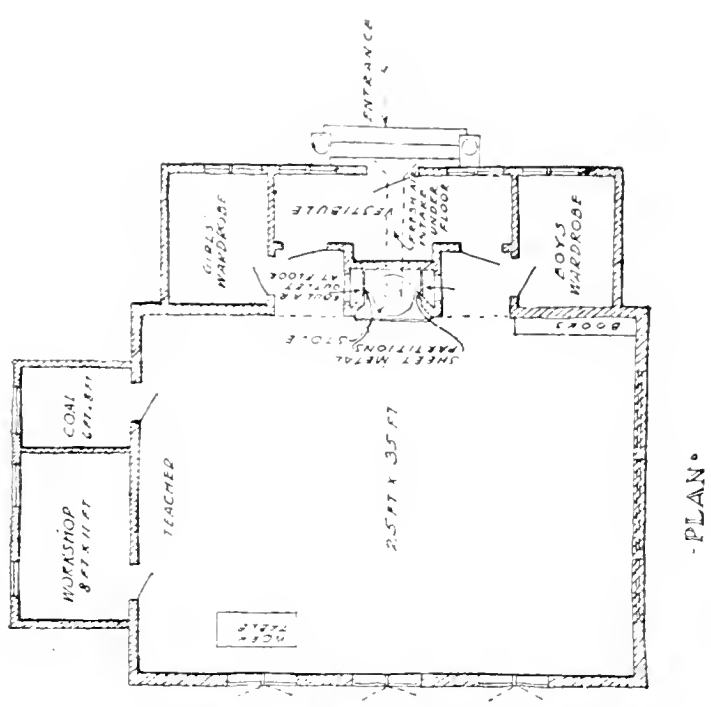
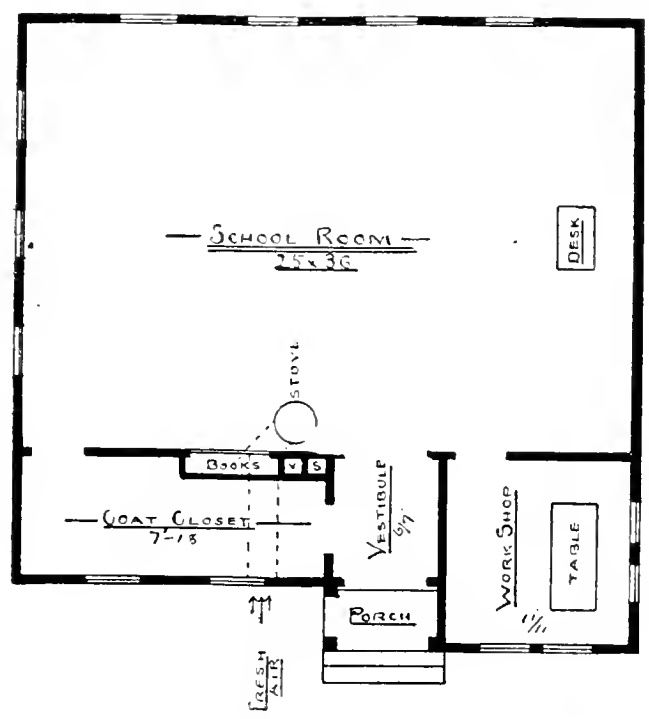
Here is a plan that was drawn at my suggestion by the present architect of the Chicago Board of Education, Mr. Dwight H. Perkins. For a single room building it seems to me pretty nearly

ideal. Of course it may be varied to suit different taste, but be sure that the variation is to suit taste and not the lack of it. There is not one feature in the plan that is not essential. Notice that there are not cross lights and there should never be. The windows are on one side only. The work shop and coal room may be at the opposite end if you choose. The plan that follows is just about as good, though it has but one wardrobe. It was made by one of the best school architects in the State of Illinois, or in the United States for that matter.

After all is said and done the fact still remains that schools of five, six, eight or ten children can never be very effective schools. The condition of these schools was fully set forth in the masterly address which you listened to last night from Dr. L. D. Harvey. He left nothing to be said upon the subject. The problem is up to the farmers as to what kind of school they wish to support. That the little school house with its ungraded school was the school in which most of the farmers of Illinois got whatever education they have, is no argument for its continuance. The fathers of many of these farmers made their own shoes and some of them shod their own horses. Their mothers wove the cloth used in the family and knit the stockings. Most of these farmers did all of their riding as children in lumber wagons and many of them were drawn by oxen, but there is no argument in all of these facts for the continuance of such conditions. The farmer has no objection to a carriage or a surrey which has replaced the lumber wagon, and a spinning wheel or a loom, in a modern farm house would be a curiosity indeed. It may as well be conceded at once, that the splendid success wrought out by the farmers of Illinois is not because of the little ungraded school in the country school house, but in spite of it. It was the influences found upon the farm; the being trained to work and not to be afraid of it; the overcoming of difficulties which was accomplished in the company of the fathers and being constantly in the council of the fathers upon the farms—it is these things which have made possible the splendid success of Illinois farmers. The country schools have done their share and it is a splendid work which they have accomplished, but the same is true of the other pioneer institutions mentioned, but that they are the best schools for boys and girls of the farm is no more true than that they are the best schools for the boys and girls of the villages.

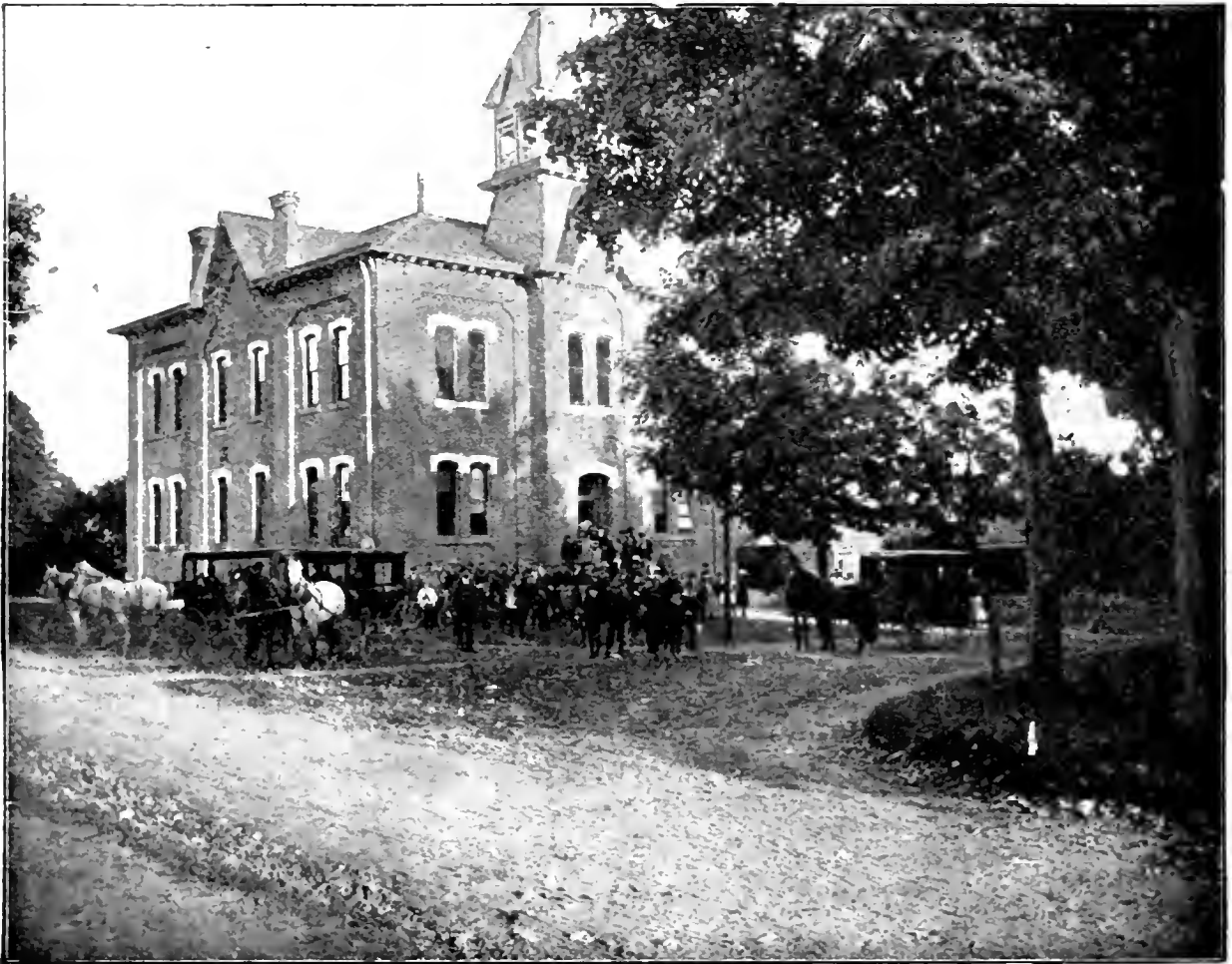


G.W. ASHBY ARCHT.



-PLAN-

The last few years have demonstrated that a graded school may be set up and sustained among the farmers. Almost all of the northwestern states, and many of the eastern, have laws making the establishment of such schools a possibility, but there is no state in which their establishment has been made compulsory. For the past six years our splendid State Superintendent of Illi-



nois, Alfred Bayliss, has been working incessantly to have a law enacted by the Legislature which would allow any given community in the State of Illinois to consolidate its schools, establish a graded school and transport the children to and from school in wagons. Mind you that all that is asked is that the farmers be allowed to do this thing if they wish to do it. In other words that they may be allowed to give their children better opportunities for education through the expense of their own money, and this certainly does not seem an unreasonable request.

Certain religious influences have been brought to bear which have acted upon the timidity of the petty politicians who so large-

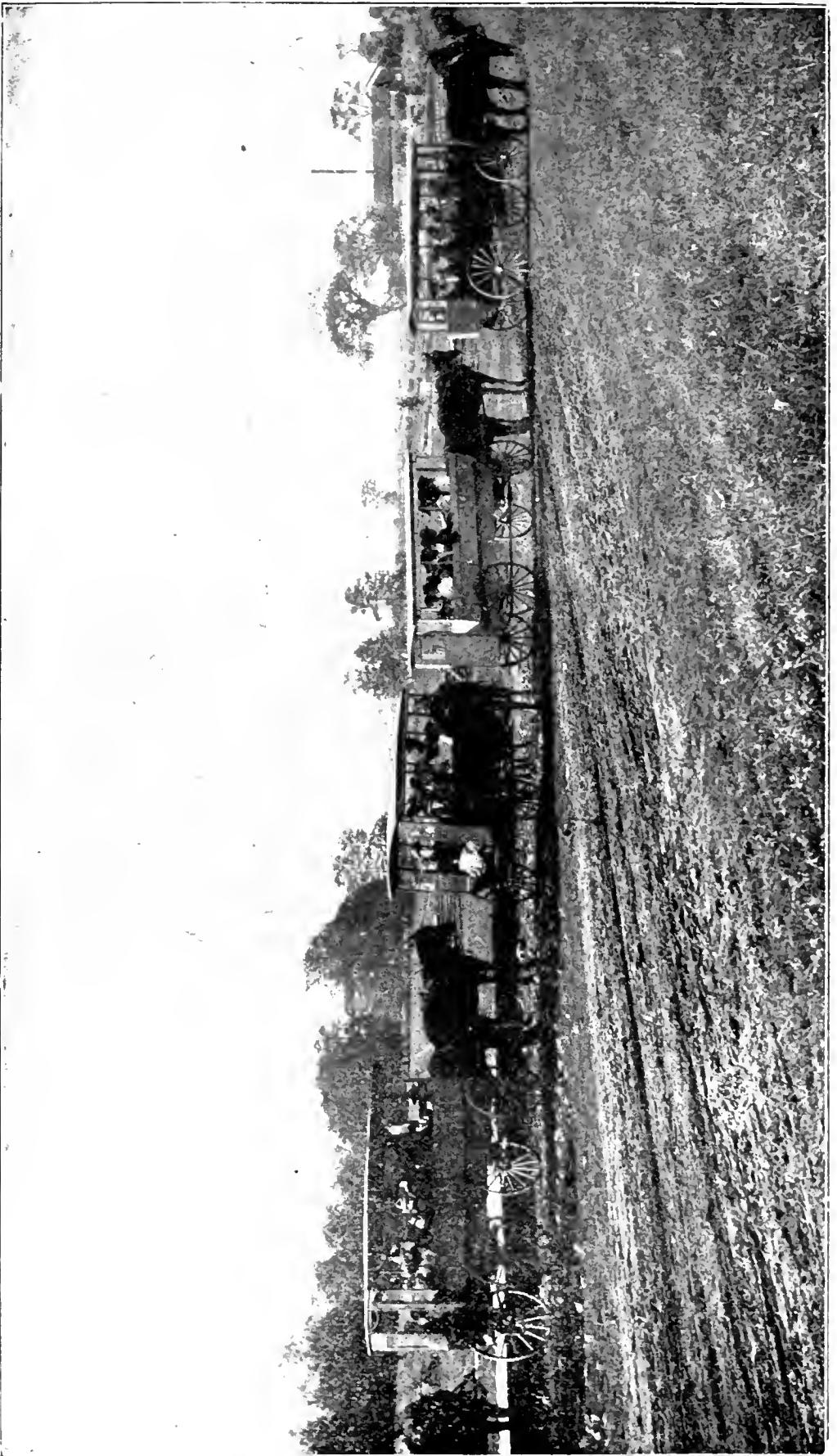
ly make up the Illinois General Assemblies. One bill giving such permission was gotten through the legislature, but was vetoed by a weak executive. It is hard to understand why any organization, political or religious, can object to such permission. No argument has ever been brought against it and no valid argument against it is possible and even Illinois will sooner or later grant this boon to its girls and boys.

It was my privilege, two or three years ago, to visit certain consolidated schools in the state of Ohio. In one township, nine little schools had been closed and one graded school established in the center of the township. It was a purely rural community, no village or hamlet being found within it. The school has four rooms, the highest room being occupied by a high school class under a four years' course. The school house is a very plain affair as you see, and there is the same unaccountable absence of trees in the yard that one finds elsewhere. This is stranger in Ohio than in Illinois, because Ohio is pre-eminently noted for its magnificent trees. They could be found everywhere else in this township except about the school house. (See page 65.)

Soon after I entered the school, which was upon a cold raw day in the latter part of November, the principal asked if we would like to see a fire drill, and within five minutes, all of the children in the school were ushered out upon the walk completely clothed in the wraps and with whatever else they would wish to carry home. Two or three minutes more found them back in their seats, but I had thus a chance to see the entire school together. The instructions in the school were most effective and I wish you to look into the faces of the children as they are thrown upon the screen.

The primary room contained children in the first and second reader, and there were about fifty of them. Just imagine fifty little farmers in one school room, all in the first and second reader. A brighter, more intelligent, and happier set of children I have never seen together. The second and third rooms had fewer children, perhaps forty in each, under equally favorable conditions.

I talked with the children in each room about their school; how they enjoyed the large school as compared with the small ones and also the coming and going. All were enthusiastic, after having tried the central school for several years. The most re-



markable, because the most unusual feature of this school, was the high school room in which were thirty-five of the finest boys



and girls that I have ever seen in a school house. They were doing high school work of such a character as to admit them, at



graduation, to any college or university in Ohio and to many higher institutions in other states.

Now remember that every one of these girls and boys comes

from his farm home in the morning and goes back at night to assist about the farm work. They are not taken away from home to the village at this most impressionable period of their lives and not only do they enjoy the companionship of fathers and mothers in their own home, but they also make themselves useful as a part of the home institution, and any day in which there is a failure in their home duties, there is a partial failure in the



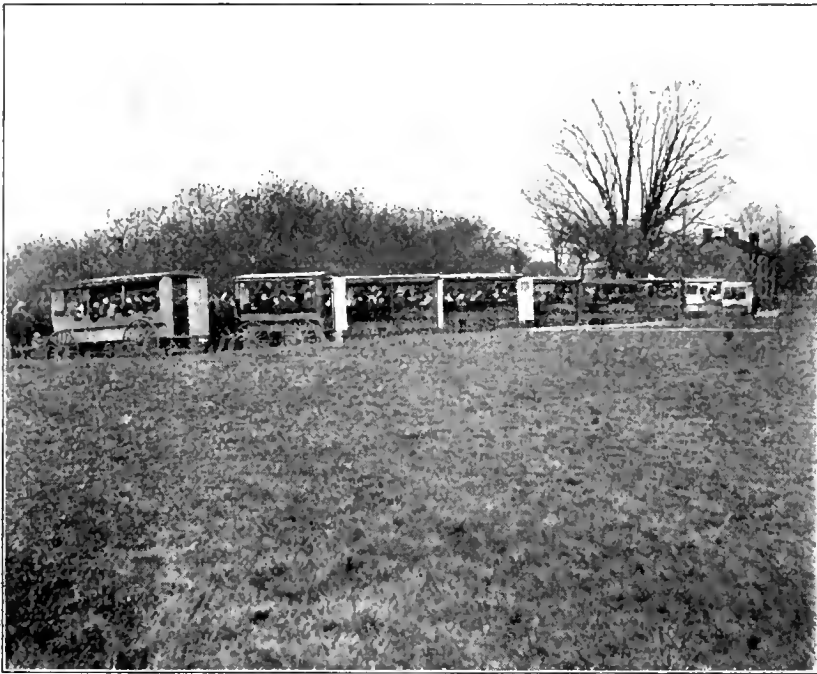
home institution. This responsibility along with the good health that comes from the farm lives, gives them a splendid ability to work and "do things." I have yet to see elsewhere so keen appreciation of school privileges as I saw in this high school room.

And then comes to me the tremendous possibilities of this sort of school, situated among the farms, so vividly pointed out by Dr. Harvey last evening, and for which your superintendent Frank H. Hall is doing such splendid work. Scientific and intelligent farming may well form part of the course of study of rural schools. The schools could afford as principals the graduates of your State university and these boys and girls as pupils are sufficiently mature to appreciate the subject matter he would bring to them from its agricultural department and they would be intensely interested in this subject matter because it would have to do with their experiences on the farm. I think the most inspiring classes I have ever seen at work were composed of fifty or more farmers, ranging in age from one score years to three

score and ten at a State Farmers' Institute at Rockford several years ago. The teacher was a young man from the State university. Every boy in the class had as subject for study, an ear of corn, and to say that he paid enthusiastic attention, but faintly states the case. I heard some of these same farmers say:

"The best thing about these institutes is, they make us think."

I was intensely interestd, recently, in a chart of the cross-section of a kernel of corn, prepared at the State University and



shown to me by Frank Hall, and I thought of its developing power as matter for study as compared to the boundary of Nubia or the situation of the particular place where Cape Guardafui butts into the sea.

No other such richness could go into the farm school curriculum as a study of intelligent farming—provided that the teachers are up to it and the school conditions are such as to make it effective. The most powerful argument for this sort of thing is that fathers and mothers would have a vital interest in at least one study of their children and would study along with them. Imagine the impulse to school work that such an interest would give if it were at all general.

At the close of school, at my request, the nine wagons were drawn up in front of the school and all were loaded before any were driven away. Then with a waving of handkerchiefs and

shouts of "Good-bye" they left us. It was one of the most inspiring experiences, this day in the consolidated school, that I have ever had and I only wish that the farmers here assembled with the thousands of other farmers in the State of Illinois, could see such an object lesson as I saw that day. There would be no question about what the next legislature would do in granting of the privilege to establish similar institutions in this State.

If there is one thing more than another for which the politician lays his ear to the ground, it is to catch the voice of the farmer.

To show the effectiveness of the school in question, I wish to call attention to the following statistics of the week's attendance, for I was there on Friday. It might be the attendance of any week in the year. The table shows the entire enrollment, the membership of the school and the attendance on each day of the week:

Attendance of the Centralized Gustavus Township School, Ohio, for the week ending Nov. 22, 1891.

ROOM	Enrollment	ATTENDANCE				
		Monday	Tuesday	Wednesday	Thursday	Friday
1	58	55	55	56	55	54
2	41	40	41	39	40	41
3	27	24	25	27	27	26
4	36	35	33	33	35	35
Total	162	154	154	155	157	156

On the black-board from which I copied this table I noticed the figure two out at the right and asked what it meant? The principal said that there had been two tardiness during the week, an unusual number and he added, significantly, that the two children that were tardy lived just across the street from the school house.

The entire enumeration from six to twenty-one was 220. Of course this includes many who have finished school or were in higher schools.

The enrollment for the last year was 170. All of the children of the township from six to sixteen were attending school—absolutely all of them. Ohio has a compulsory school law, from six to sixteen which is observed, but these children needed no such law. It was attraction, not compulsion which brought them to school every day when they were well enough to attend. Just

imagine 160 children from all parts of a township, going to school for an entire week and only two of them tardy. In the administration of this school, the drivers of the wagons are just as carefully selected as the teachers and they are placed under bonds. They must deliver the children at school by 8:45 each morning. The wagons are made perfectly comfortable through the use of curtains and robes, and in case of very severe weather even of heated soap-stones, so that the trips to and from school are made in comfort. I am often asked:

‘Does it cost any more?’

Yes, it does, but it is worth more—by twice or thrice. Horses cost more than oxen, reapers more than cradles, watches more



than hour glasses. The per capita cost is about one-quarter more.

The pleasure in this school, as in other social institutions, comes largely in the association of the members. The biggest thing in this world is friends and each child in the school knows all of the children in the township and calls them friends. You see how much bigger outlook the child has for social intercourse and pleasure, but there is something else comes to the children in the classes. A class of one or two or ever three can have small inspiration, but a class of ten, twelve or fifteen is a very different proposition. Instruction in a well-conducted recitation comes as much from the children as from the teacher, provided the class is of adequate size, and this was the case with every class in this school.

The spending an hour or two hours on the road to and from

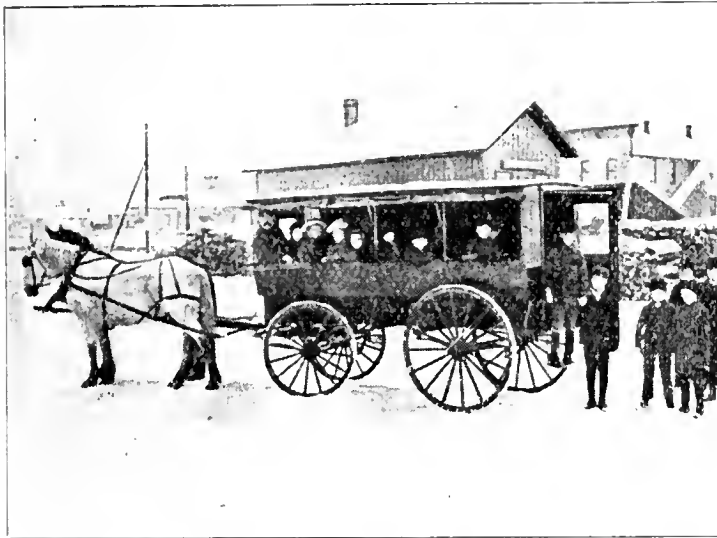
school each day, tramping through mud and storms and deep snow, is not a profitable business. It may, in a certain way, develop strength, but not nearly so well as would a participation in useful work at home. Tramping on the road is a labor which counts for nothing. Cutting wood, washing dishes, caring for stock, sweeping and dusting the house and learning to cook, count for much. The physical strength of the children upon the farm may so easily and naturally be turned to some account. Besides there is no quarreling and no chance for ill-practice on the way to and from school. But the best part of it all is that the boys and girls have associations with father and mother at the time of life when such association is most vital to them.

Oftentimes these same wagons are used in the evening to convey the parents to lectures or other meetings in the same school house where the children have been attending in the day time. And this is one of the great possibilities of the centralized school. Is it not time that the farmers of Illinois should make a demand upon the legislature for the privilege of conducting their school affairs in any given township or community as they shall see fit, so long as they spend only their own money in doing so.

I thoroughly realize that the improvements suggested in these educational meetings of this farmers' institute must come slowly that it will be many, many years before the best is reached, if it is ever reached, but each year must see marked improvements. The old school house must be made respectable and many of them may be made beautiful. The improvement of interiors through the intelligence and devotion of teachers during the past ten years have been amazing. The directors should meet them half way. Certainly the surroundings of every country school may be made beautiful simply through planting. I have insisted in this paper and I insist again that an appreciation of beauty is a necessary part of education. It is what makes happiness in this life if anything does. The school house must be made sanitary and this will be a matter of no great expense. This sanitation has to do with heating and ventilating; with the lighting and especially with the proper seating of the rooms. The walls of the school room should be tinted, not left blank white, or what is worse, decorated by the smoke from the stove, with here and there an addition from mischievous boys. We must have planting in the school yards, trees, flowers and climbing vines.

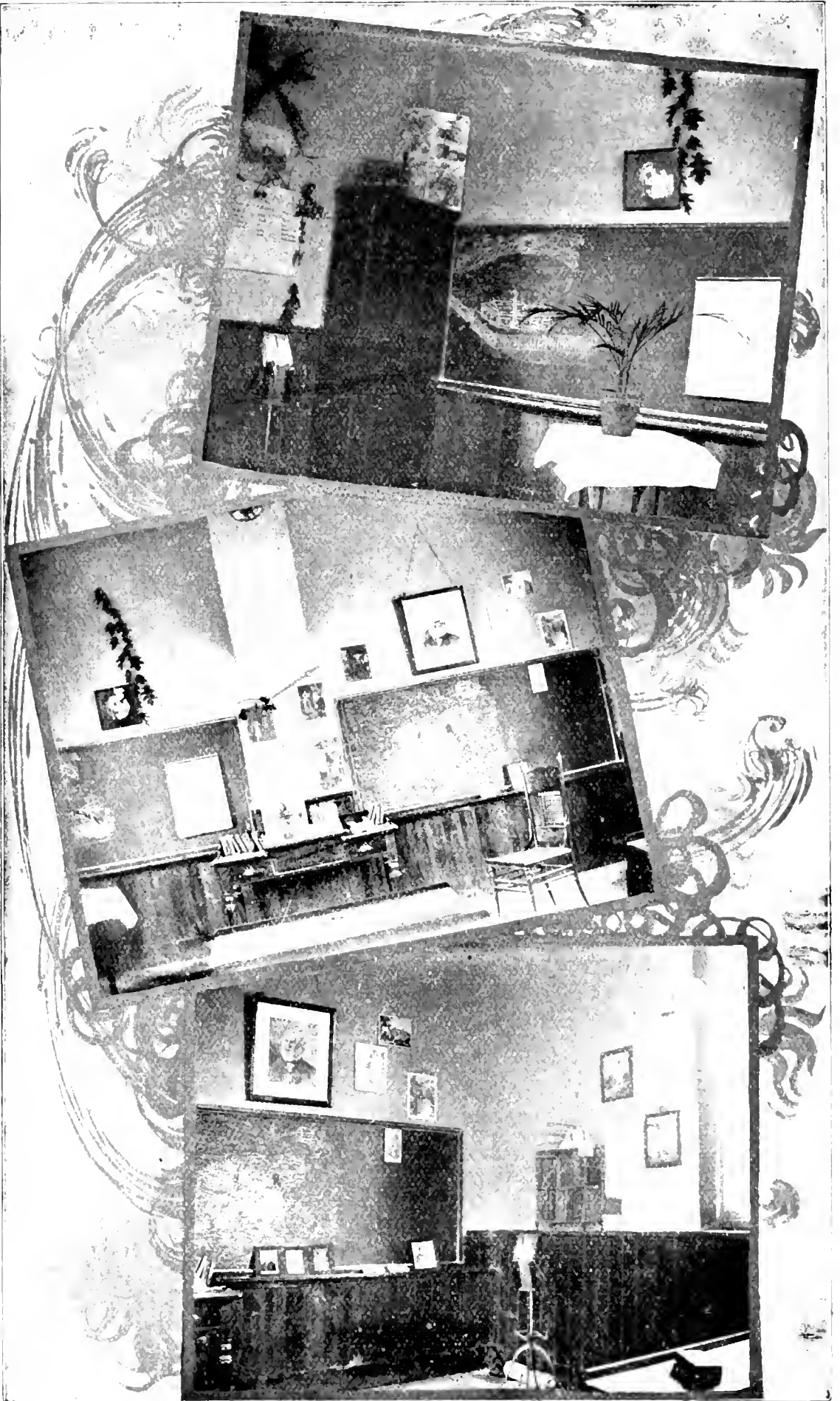
The most effective adjunct of any school, whether in village or country, in modern education, is the school garden. The garden at home is a very different affair from the school garden, because the latter is looked upon as a part of education, and how effective and beautiful a part it may be is known only to those who have tried it. There are tens of thousands of school gardens in Europe and almost none in the United States.

There must be supplementary reading and library books for home reading, and there must be pictures on the walls. Pictures which shall appeal to the experiences of the children, and they must be works of art. Such pictures are teachers and they teach



right all the time. Then, with the trees and flowers about the school house will come the birds, the most beautiful creatures in God's creation; and they are not only beautiful, but they are vastly useful. I would have the girls and boys know that farming and gardening can not be carried on successfully without the aid of birds, and as part of their education I would train the children to love and protect them.

There is much that is possible in America education besides what we have been getting out of it. This finer side of education for which I plead will be the most effective means of making better citizens, and will promote that best of all desirable institutions in this country, the prosperous and happy farm home.



LANDSCAPE GARDENING.

By R. W. Fisher.

"It does not matter whether we have in mind a great park or a small city square, a large estate or a modest door yard, we must go about our work in an artistic spirit if we want a good result. Two trees and six shrubs, a scrap of lawn and a dozen flowering plants, may form either a beautiful little picture or a huddled disarray of forms and colors."—Mrs. Van Rensselaer.

In America there are two general systems of landscape gardening,—The artificial, or geometrical style which consists in laying out and planting grounds in squares, circles or other geometrical designs. The changes in grades are usually obtained by steep and abrupt terraces and the trees and shrubs are trimmed into some regular and often grotesque shape.

The second system is called the natural style, and is more generally used in this country, and in the eyes of Americans at least, produces better effects. Landscape gardening done after the natural style attempts to follow nature in the treatment of plants, shrubs, and trees, both in training and grouping.

By this system the walks and roads are laid out in graceful curves. Trees and shrubs are grouped along the border of the grounds and in curves or ends of the drives. Changes in grade are made by graceful slopes without terraces, and the trees and shrubs induced to grow into their most natural shape, while they are grouped with reference to each other to produce the greatest variety of natural beauty.

In this system of landscape work straight lines, either with walks, drives or tree rows are discouraged, yet we find no regular geometrical figures in curves or squares.

In cities where the space is usually limited because of the small sized lots, the artificial system is often used to advantage, but even then better effects can often be produced by planting shrubs, if there is not room for trees, along the borders, in the back ground, in the angles and curves of walks, and leaving an open space in the center for lawn. In the country, however, where space is not a factor, the natural system is much more desirable.

While it is impossible to enumerate definite and exact rules to be followed in every case, yet the natural system of landscape gardening may be defined in the following general terms.

The lawn should be considered the ground work of the picture and all trees, shrubs or flowers should be along the borders or in angles or curves of drives or walks or in the back ground, leaving the center space open and free from all trees or shrubs. The trees and shrubs are grouped in various ways to produce variety in form, color, size, etc. The walks and drives are not regular in outline or contour but go from place to place either in straight lines or with graceful but irregular curves. Flower beds that have to be put in regular shaped designs are all concentrated in one place, usually in the back ground and never made a prominent feature in the landscape. Hardy perennial flowers are now used quite extensively for borders along walks, or edgings for shrub or tree groups. The whole system of natural landscape gardening may best be explained and accomplished by perceiving the natural landscape pictures found in all our mountain canyons and attempting to reproduce these beautiful effects upon our lawn, whether they be in the congested city or open country.

It is not necessary, as many think to secure the services of a professional landscape gardener to plan and plant the home grounds. However, it is necessary before desirable results can be obtained to have a knowledge of the materials to be used in order that the right varieties of trees, shrubs and flowering plants be procured, and properly grouped. This knowledge may be gained by reading descriptive books, pamphlets or nursery catalogs, or observing the growth and behavior of the plants in other places.

Before anyone, amateur or professional, begins to decorate a place he should have a definite and carefully worked out plan of the space to be planted, and the more complete and detailed the plan the better.

The Lawn—Upon no one thing does so much depend in beautifying home grounds as upon a good lawn, and it too often happens that the poorest soil obtainable, that from the excavation for the buildings, is used for producing the grass carpet.

A good lawn cannot be made except on rich soil and if it is necessary to put the heavy clay from the cellar and building excavations on top, with it should be incorporated a liberal supply of rotten manure in order that the necessary plant food and humus for plant growth be present.

The surface should be carefully graded and leveled before seeding is done and there should always be a gradual slope away from buildings in order that surface drainage may be obtained in wet weather. Steep and abrupt terraces are discouraged in the natural style of landscape gardening because they are unnatural and hard to maintain in perfect condition. In cities with lots several feet above the street grade terraces are sometimes necessary.

Only those grasses should be planted that make a fine spreading growth, with underground stems. The best kinds for general purposes are Kentucky Blue Grass (*Poa pratensis*), Bent Grass (*Agrostis alba*), and (*Agrostis vulgaris*), and White Clover, (*Trifolium repens*). Early spring is the best time for sowing the seed although it may be done at any time during the growing season if conditions necessary for germination are maintained.

The amount of seed to be used will depend some upon the season when sown. Less seed is necessary in March or April than in June, July or August. It is a very general practice to plant several kinds of seed, the Kentucky Blue Grass seed, and white clover forming the most popular mixture in the Northwest. About two bushels of Blue grass and 10-lbs. of white clover per acre is a good allowance.

Driveways.—Roads and walks in themselves add nothing to the beauty of a landscape, yet they are a necessity in both the home and public grounds and, therefore, have to be considered in any landscape plan. One of the first things to be considered after the house and other buildings have been built, is how to get to and from them, or in other words where shall the drives and walks be placed. A properly located and well built drive or walk may, however, be made attractive and at the same time very useful as it offers an easy and smooth approach to the buildings. The drives and walks should be located where they will offer the most convenience in getting to and from buildings and as nearly as possible give the shortest distance between the points of travel, yet unless the distance is very short, straight lines should be avoided and the drives and walks laid out in graceful curves. By properly planting the borders with trees and shrubs a curved walk can be made to apparently offer the shortest distance between points and at the same time avoid the formality and sameness of a straight line.

The width must vary with the amount of travel. In private places walks three to five feet are usually wide enough while roads 10 to 15 feet will give sufficient width.

After the lawn has been established and the walks and drives located, the trees, shrubs, and flowers can be planted; and the beauty and naturalness of a landscape depends very much upon the proper selection of varieties and the methods of planting and grouping them upon the lawn. To be successful and produce the best results it is imperative that the planters become familiar with all the materials to be used.

The illustrations produced here will offer suggestions how private grounds can be laid out, yet every place has to be given a particular treatment, which has to be determined largely by the owner, if the service of skilled landscape gardeners is not secured.

The trees, shrubs and flowers suitable for Montana conditions are enumerated below, yet the different portions of Montana demand different plants, which can only be determined by experience.

The following list includes some of the hardiest and best shrubs tested at the Experiment Station during the past seven or eight years. These plants have been selected not alone for their hardiness but also because they are well suited to lawn planting—having either beauty of form, flower or foliage.

Barberry.—The barberries are a very useful and hardy class of plants. They may be used to good purpose for grouping in the shrubbery, planted alone as specimen plants or even for the purpose of a low hedge. The greenish, yellow flowers are usually borne in clusters, followed by red or purple berries, which often stay on the bush until late in the winter producing a beautiful contrast. The varieties giving the best results at the Experiment Station are *Berberis Thunbergii*, DC. In this variety the flowers are greenish in color, borne singly, and are succeeded by scarlet berries which hang on the plant all winter: this with the bright green foliage which assumes brilliant red tints in the fall, combines to make it an attractive plant throughout the year.

Berberis vulgaris, L or common barberry. This plant may be killed back slightly the first year or two but later is very hardy, a good plant for planting along the borders and back ground.

Berberis vulgaris purpurea, Purple leaf barberry. This variety is similar to the common barberry in the habit of growth and

hardiness. Its deep purple foliage, greenish yellow flowers, followed by bright red berries which hang on the plant all winter make it a desirable plant for the lawn.

Caragana or Siberian Pea Tree.—Of all the shrubs that have been introduced into the Northwest, none promise so well as the plants of this type. Two species have been tested at this Station and have proven absolutely hardy under all conditions. The plants are readily grown from seeds and will produce in one season plants large enough to be planted into permanent position. These plants have beautiful foliage and yellow pea like flowers which develop into small brownish pods producing an abundance of seed. *Caragana arborescens*, a large shrub from 12 to 15 feet high and *Caragana frutescens*, a beautiful little shrub from 4 to 5 feet high have been growing in the station nurseries for several years.

Crataegus or Hawthorne.—There are several species of thorns growing along the water courses in Montana. These make very desirable ornamental plants when placed upon lawns and well cared for. The white clusters of flowers in the spring and later the scarlet berries add to the variety of any landscape. Plants of this character are valuable for hedges, screens, or grouping in the back ground to give variety and form protection for more tender plants.

California Privet has been grown at the station for about eight years. The tips of the branches sometimes kill back but not enough to seriously injure the plant. This plant holds its leaves very late in the fall, sometimes holding them throughout the whole winter. The California Privet is much used as a hedge plant and it is one of the best for that purpose.

Lonicera tatarica, (L.) Tartarian honeysuckle has been grown here for several years and is perfectly hardy. This is a large growing shrub originally from Siberia. The flowers which vary in color from white through shades of rose to red are borne profusely in early spring.

Buffalo Berry, Shepherdia argentea, Nutt.—This is a plant native to this state and is valuable as a hedge or protection plant. When well cultivated and trained it makes a good plant for the lawn.

Spiraea VanHouttii.—This a very popular plant and is one of the best for the shrubbery border or as single specimens on the

lawn. It is a very strong grower attaining a height of from four to six feet, producing a profusion of white flowers in clusters early in the spring, and is beautiful on account of its graceful shape and dark green foliage.

Syringa or lilacs are universal favorites. They are beautiful in flower and foliage and are among the hardiest plants in the state. There are several species in this group and numerous varieties, thus making it possible to get considerable variation in flowers, foliage and size of plants. The common lilac, *Syringea vulgaris*, with its numerous varieties, has been in cultivation for many years. The plant is absolutely hardy under all conditions, and will grow and produce flowers where other plants die. This plant often attains a height of from ten to fifteen feet, and produces flowers ranging in color from white through shades of blue and purple to red. It is valuable in the shrubbery or as single specimens upon the lawn.

Other species of the lilac found hardy here are *Syringa villosa*, a lower growing shrub than the common lilac. The flowers are an attractive shade of pale bluish rose with a delightful fragrance, not as strong as *S. vulgaris*; and *S. rothomagensis*, a tall growing lilac with small leaves and purplish violet colored flowers which are delightfully fragrant.

Viburnum opulus sterile or common snowball. This is a well known shrub suited to lawn planting in most parts of the state. When in full bloom the numerous white flowers are very attractive. In exposed situations the terminal shoots are sometimes killed back but ordinarily not enough to seriously injure the plant.

Many roses can be grown successfully in Montana if they are given sufficient protection in winter. The Persian Yellow and *Rosa rugosa*, a single rose admired for the beauty of its foliage, are the only roses of distinct quality tested here that are absolutely hardy without some protection.

Below altitudes of 4,500 feet the Carolina Poplar is undoubtedly the best and most generally planted of any tree we have. The beautiful shape of tree and foliage, fast growth, freeness from insect and fungous pests and its ability to endure the smoke and dirt of cities make it a very desirable tree for planting on streets or around dwelling houses. In the high altitudes, particularly where sufficient water is not available, this tree is

subject to sunscald in the top and trunk. On the College campus we have a row of poplars eight or nine years old, one-half of which is on ground where water could be applied in dry seasons and late in the fall. The other half of the row is on higher ground and the soil has often become very dry. In the part of the row where water could be given when needed the trees have made a good growth with but little injury from sunscald or other causes, while those on the ground that became dry in the fall have suffered very much from dying in the tops, bark cracking on the trunks, and several of the trees have died. The soil, altitude and weather conditions are the same in both cases, thus indicating that the cause of the trees dying is directly due to the insufficient water. At this altitude (4875 feet) the Carolina poplar can be grown and will make the best tree for shade or ornamental purposes, if enough water is given to keep the soil about the roots moist at all times. In watering trees it is necessary to apply water not only immediately around the trunk but far more necessary to get it where the fine rootlets are, often several feet away from the main stem. The root surface extends over much wider area than does the top and it is necessary to have this in mind when irrigating.

Next to the Carolina Poplar in desirability for a street tree is the American or White elm. A tree that grows slower, but is more endurable and reaches a larger size than the poplar. The elm like the poplar does best when grown on moist land, and in fact will not endure drought at all. When grown in good soil, given plenty of moisture, and properly cared for this will make an excellent tree to plant on the lawn or along streets and driveways. This tree is recommended only for places where there is plenty of water and where the water will be applied so the roots can use it.

The American or White ash is a good tree for street planting in the lower altitudes of the state. It makes a tree from 90 to 120 feet high on good moist ground and as far as tested is hardy in Montana. It is not as desirable for general planting as the Carolina poplar or American elm.

The Soft or Silver maple is hardy in western Montana in the valleys, and makes an excellent tree for shade or ornamental purposes. It should not be planted in exposed places as the wood is very brittle and the winds break the tree badly unless

they are protected in some way. The Norway maple, a slower growing tree than the preceding is also good for planting in western Montana and in the lower valleys of the state. The Tartarian maple, a small growing tree, often shrubby in nature is perfectly hardy in all parts of the state but on account of its size it is not desirable as a street tree.

For parts of the state in the high altitudes, above 4,500 or 5,000 feet the box elder, *Certinensis* poplar, Canada poplar, Laurel leaved willow, white willow, and our native cottonwoods and quaking aspens will give the best results. With good care in planting, cultivating and watering, a few or all of the trees mentioned may be grown.

For ornamental purposes on the lawn the mountain ash, the white birch and its variety, the weeping or cut leaved form are recommended. These trees are very hardy and can be grown at altitudes as high as 5,000 feet or higher with success. Both the ash and white birch are very beautiful trees and excellent for lawns but do not grow large enough for street planting purposes.

THE IMPROVEMENT OF HOME GROUNDS.*

By F. Cranefield, of Madison, Wisconsin.

There are many reasons why the home should be made more attractive without as well as within, but probably the one of most importance is the influence that beautiful surroundings may exert upon the minds of children. A well kept lawn with shade trees, flowering plants and vines will unconsciously develop in the child's mind a love of home and of the beautiful in nature that may in later years repay many fold the expense involved, while bare and cheerless surroundings will engender a feeling of discontent as well as a lessened capability to appreciate the refinements of life. The decoration of the home grounds is of as much importance in the creation of refining influences as the furnishings and decoration of the interior of the home.

Bare walls and a comparatively small amount of furniture will answer for the actual needs of a family, but everyone aims to have something more than this,—an attractive wall covering with at least trifling ornaments and handsome pictures. The lawn should also be provided with a ground cover and beautiful pictures of trees, shrubs and flowers.

Aside from the aesthetic view, there are other and more material reasons why the home grounds should be made restful and attractive. The comfort of all occupants of the home should be considered. A leisure hour during the heat of summer may be spent with more of comfort and refreshment on a shady lawn than elsewhere. The women of the home, especially, appreciate and have a right to ask for cleanly and pleasant surroundings.

The third view, and the one last to be urged, is the question of the increased value of the premises arising from such improvements. If no desire is felt to beautify the home grounds for the sake of the comfort that may be derived, or of the influence that may be exerted, it is well to bear in mind that the value of the premises is materially enhanced by the judicious planting of trees and shrubs. The place in which a tree stands generally determines its value; if in a forest, it may be worth ten dollars for fuel, if on the lawn, it may add one hundred dollars to the value of a place.

It is scarcely conceivable that a man could live fifty years in one spot without planting a single tree or shrub for shade or

*Extract from Wisconsin Experiment Station Bulletin No. 105.

ornament, yet such is the case, as may often be seen.

The matter of expense can scarcely be urged as a reason for the failure to make improvements in this line in country homes, as there need be but a trifling outlay of money. Horses, labor, good soil and manure are all available on the farm, and native trees and shrubs may usually be found in abundance in neighboring fields and woods.

Discussion of Plans.

A definite plan should be formed before planting is begun. In order to meet with success in planting it is essential to have a definite plan of procedure. A simple plan will answer; in fact, the simpler it is the better it will be, but it must be explicit.

"It should always be kept in mind that the real beauty of a place depends upon the plan rather than the planting. The planting is to a large extent a detail, just as walks and beds are details. They should all be arranged to give emphasis to the leading motive of the plan."—Manning.

If hap-hazard planting is followed from year to year, the setting of plants wherever there may be room for them, the yard will in the end be filled with a collection of plants all more or less beautiful as individuals, but the whole lacking entirely the features of an attractive landscape. We should plan and plant so that the eye may take in the view as a whole rather than be attracted to individual specimens.

"The trouble with home grounds is not so much that there is too little planting of trees and shrubs as that this planting is meaningless. Every yard should be a picture. That is, the area should be set off from every other area, and it should have such a character that the observer catches its entire effect and purpose without stopping to analyze its parts. The yard should be one thing, one area, with every feature contributing its part to one strong and homogeneous effect."—L. H. Bailey.

It is an axiom in landscape art that the largest possible space of lawn should be maintained open and free. This gives the impression of breadth and extent which is always desirable.

The planting then will be largely on the borders. The house should be considered the central point and all planting arranged with reference to it.

It will often be possible to arrange plants so as to shut out undesirable views as well as to create vistas.



Entrance to house with hedge border.



A stone fence and entrance to house.

The view from the house should be considered no less than the view from the highway. Fig. 2 shows a common method of planting in which the trees and bushes are set without reference to any plan, and the result is merely a collection of plants and not in any sense a landscape picture. In Fig. 3 a definite plan has been followed resulting in an open lawn and an abundance of shade with many pleasing effects. Another and too common error is the planting of trees in straight lines as shown in Fig. 4. This may be called the nursery type of planting

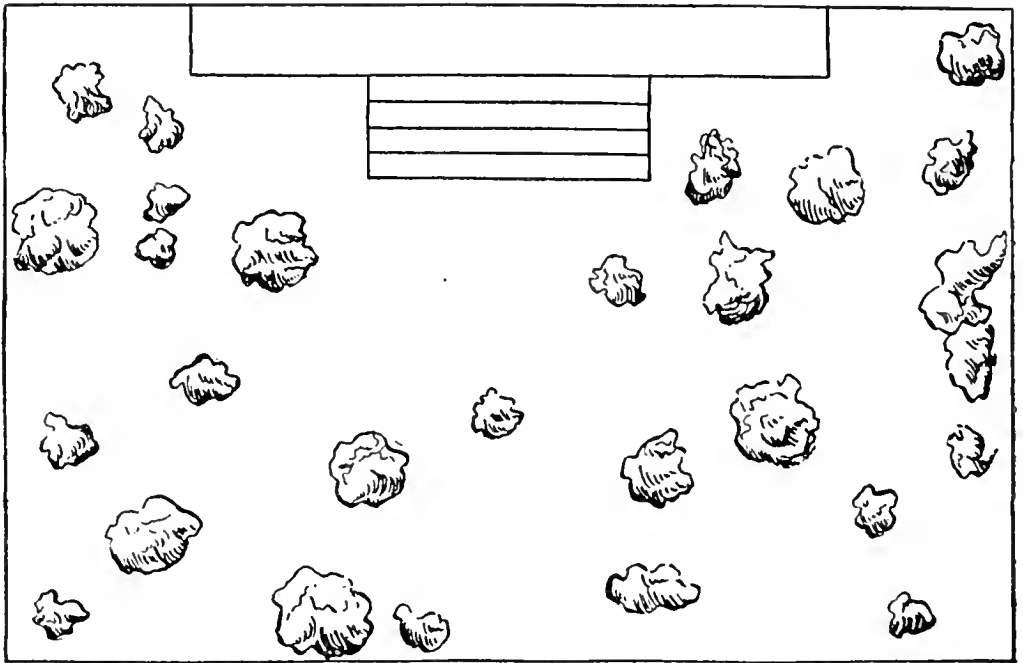


Fig. 2.—Planted but not planned.

and will result in a mass of trees completely shutting out views to and from the highway.

The farm house in Fig. 10, fronting the highway on two sides, had a drive across the lawn and past the rear of the house to the barn. Six trees, maple and elm, had been planted in the front yard. The changes shown in Fig. 11 were suggested to the owner and are being executed. An entrance to the premises near the barns has been substituted for the useless drive and five of the large trees removed. The path from the highway to the house has been supplemented by others leading to the out-buildings, garden, etc., thus affording opportunity for abundant border planting.

The ground plan in Fig. 12 contains suggestions for planting the grounds about a farm home. A continuous row of trees on

the left serves as a shelter belt for orchard and house. The border planting on the right might be modified if desired to open vistas. Shrubs have been massed about the house and a flower garden located along the rear walk.

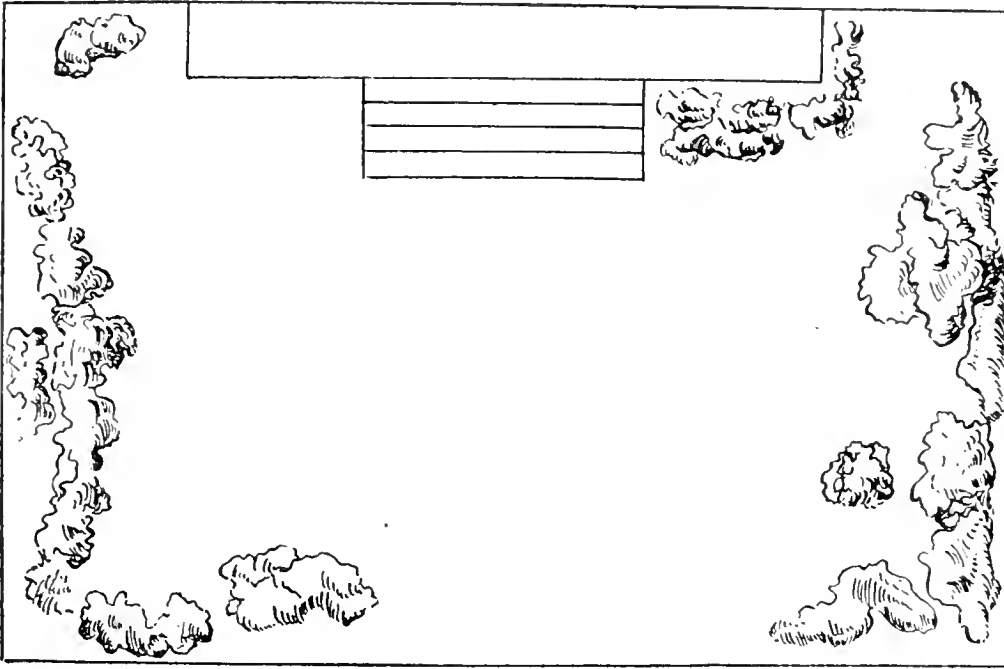


Fig. 3.—“A definite plan has been followed.”

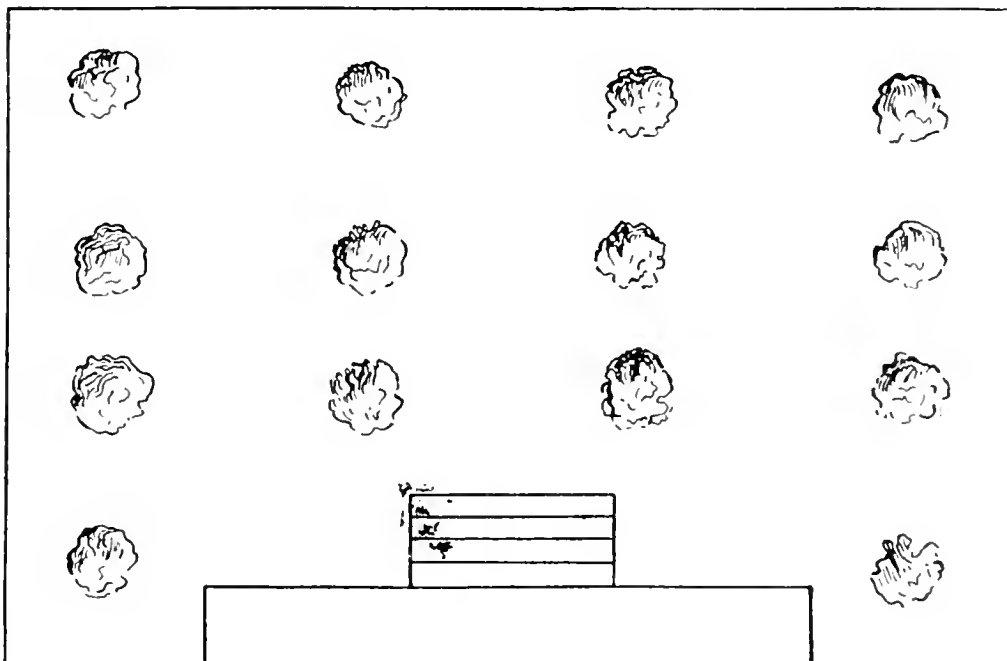


Fig. 4.—Geometrical.

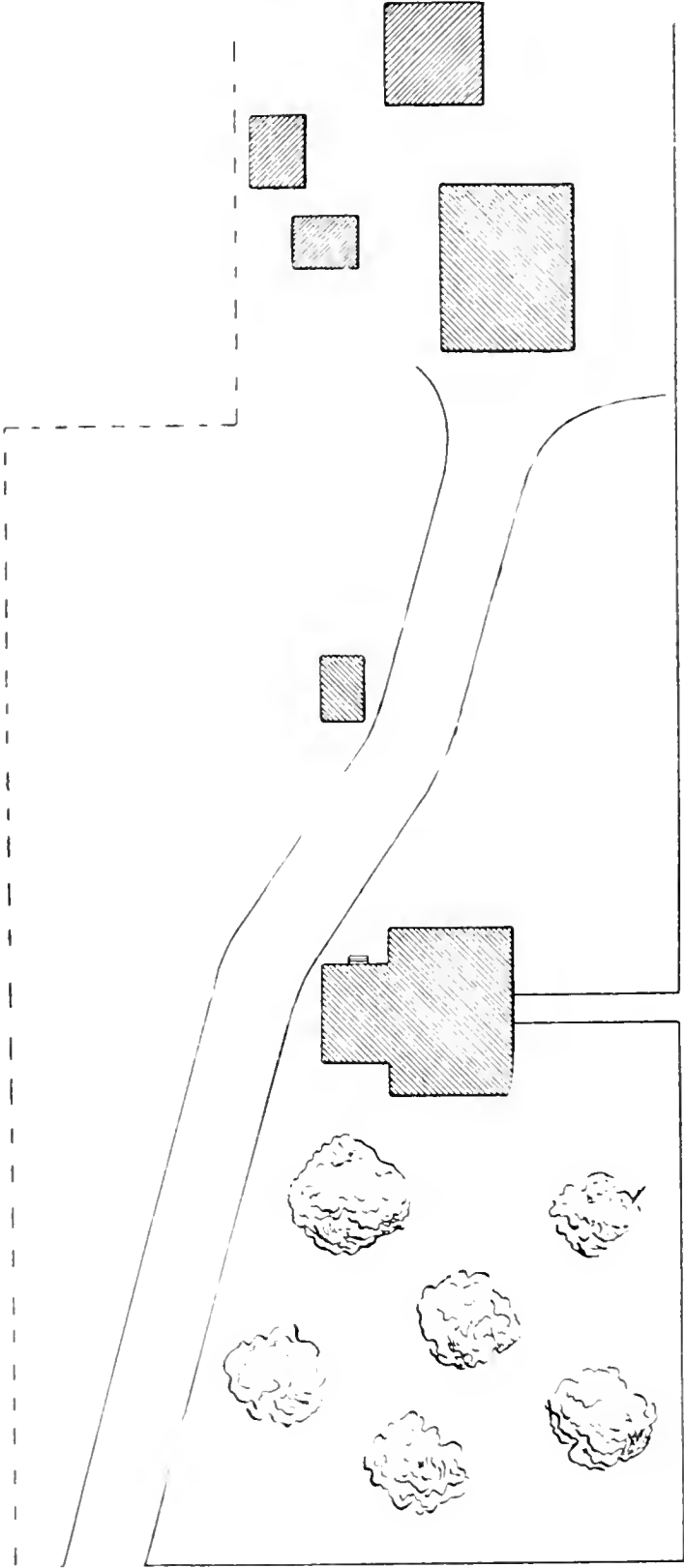


Fig. 10.—Original ground plan of home grounds.

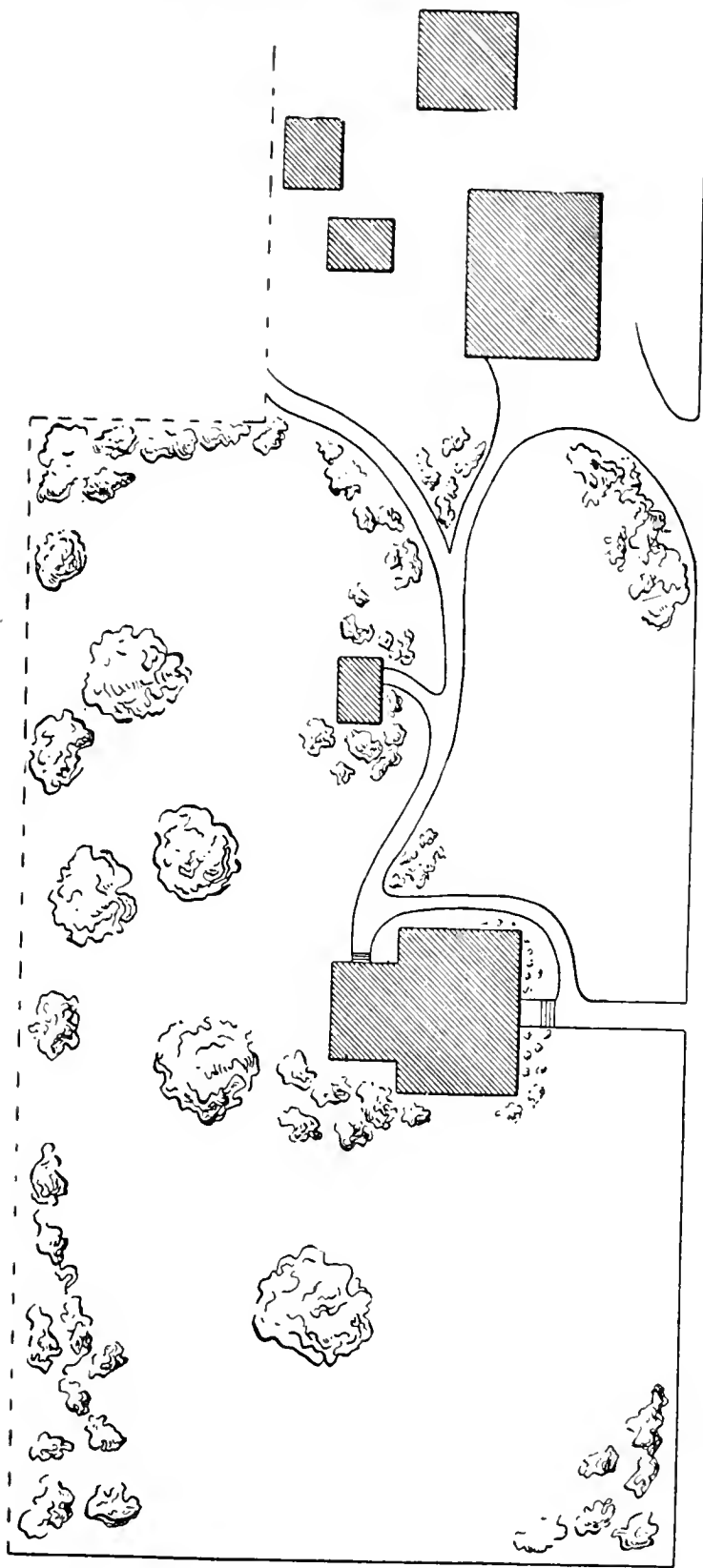


Fig. 11.—Improvements suggested for Fig. 10.

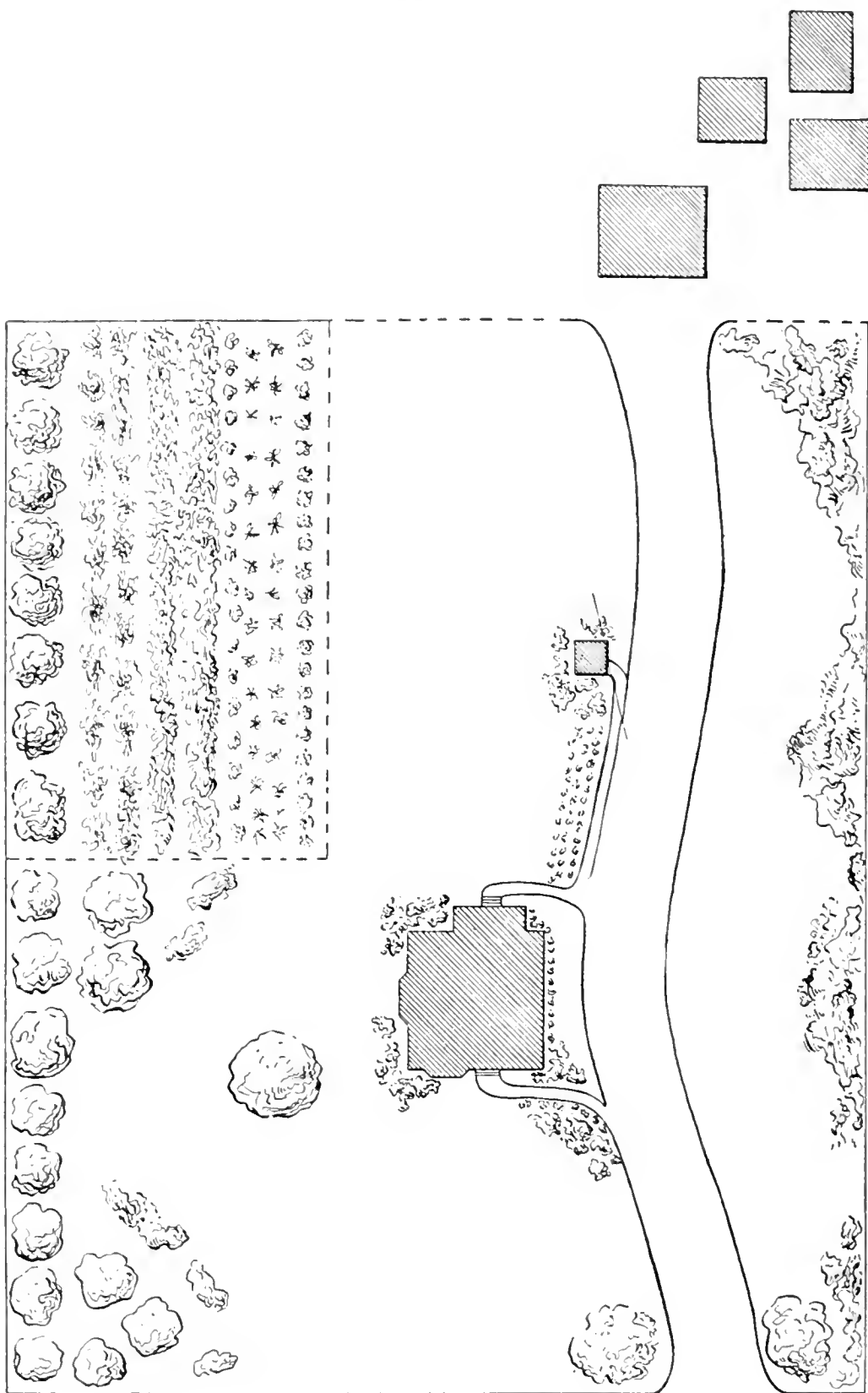


Fig. 12.—Ground plan for home grounds in country.

THE HOME WATER SUPPLY.

By V. K. Chesnut, Chemist, Montana Experiment Station.

Nothing is more essential to health and happiness than a supply of pure well-aerated water. In importance it naturally takes precedence over the food supply and it is second only to pure air, without which a person can not long remain in the fullest vigor of life.

Fortunately, however, no one has yet been able to obtain a monopoly on air. It is true that large towns and, especially, manufacturing centers, vitiate the air with smoke and gas to such an extent that homes can scarcely be said to exist in their vicinity; it is true also that some houses are not constructed with proper arrangements for ventilation, but in Montana with its scanty population and its great extent of territory there is no excuse for bad ventilation in a house where it is expected that children will be reared to that lofty state of manhood or womanhood which will ever be the foundation-stone and safeguard of the state and nation. Too much emphasis can not be laid upon the necessity of beautifying the farm home and making it attractive to the children raised thereon, but nothing will tend sooner to destroy its magnetic force than a poor or neglected supply of water. A cup of pure cold sparkling water from a deep well or spring will ever elicit grateful thanks from the thirsty traveler or from a jaded friend from the stifling city; one cup of water from a surface well or stream polluted with the germs of typhoid fever may drive our friends and our happiness away and perchance may forever blight the fond hopes and aspirations of parents who have toiled laboriously for a life time to train and educate a child who in the prime of manhood bears upon his brow the mark of genius.

The total supply of fresh water for home use comes originally from the rain. About one-third of this is returned again to the atmosphere by evaporation, another third sinks more or less deeply into the earth, where it is known as ground water, and is held there as by a sponge, while the last third known as surface water runs off through rills, rivulets and rivers into the ocean where some of the substances dissolved from the air, the rocks, and the soil are left, while the purified vapor ascends again, and again begins its circuit in the form of rain.

Pure water is made up of two substances, hydrogen and oxy-

gen neither of which have chemists been able to split up into simpler substances. They are both gases and when they are brought together and ignited or whenever any substance containing hydrogen is burned in presence of air, water is formed. It is very difficult, however, to find water that is absolutely pure and it is almost unknown even in the chemist's laboratory.

By virtue of its wonderful solvent property, the pure rain-water, falling in tiny drops through the air, dissolves more or less of the oxygen, the carbon dioxide and the nitrogen which exists as essential constituents of the air; the nitric acid generated by the action of lightning upon the oxygen and nitrogen of the air; and lastly the ammonia always found in air especially near towns where decay is going on rapidly. These gases are always largely retained by cold water free from vegetation and their presence may easily be demonstrated by heating water in a glass vessel. Before boiling begins, minute bubbles of gas ascend and break on the surface. Samples of this gas have been collected from many waters and it has been shown that, as a rule, it contains more oxygen, more carbon dioxide and more nitrogen than is present in ordinary air.

Besides these gaseous constituents rain water contains particles of the dust which are found floating in the air. This is composed chiefly of inorganic material and different kinds of microscopic organisms nearly all of which may be looked upon as harmless in their effect upon man and the domestic animals. None of the gases dissolved in rain water are injurious. On the contrary it is known that the dissolved oxygen is necessary for the existence of fish and the different kinds of aquatic animals; and that the nitrogen, carbon dioxide and oxygen are essential for the growth of plants or in the decomposition of the rock powder from which the soil is made. That they are also essential ingredients of drinking water can not be doubted especially when we consider the extremely important part taken by oxygen in the alimentary canal and in the blood.

Rain water contains more dissolved gases than surface water and is therefore more beneficial to plants. This fact has long been recognized and in order more fully to aerate water used in gardens we force it, by means of appropriate nozzles, into a fine spray. Certain marine animals, such as the coral polyp, also

grow best in sea water which is more thoroughly aerated by being dashed into spray.

Surface waters contain all the ingredients of rain water, but in different quantities, and also the inorganic and organic substances which they dissolve from the rocks and the plant and animal matter with which they come into contact. The nature and the amount of the substances dissolved by a surface stream varies greatly with the season, the rapidity of its flow and the character of the substances it meets with. The purest surface waters are those of upland streams especially those which flow over granite or other rocks that are nearly insoluble in water. These contain but a small amount of organic matter while the lowland streams may be very greatly polluted by sewage or decaying vegetation and the numerous microscopic organisms which are always present under these circumstances. Water passing over limestone dissolves a large amount of mineral matter; that flowing over alkali land or the bed of an evaporated lake dissolves a much greater quantity. About one-fourth of the weight of water of some lakes like Great Salt Lake or Lake Mono in California which have no outlet to the sea consists of inorganic matter which remains behind upon evaporation. Some surface waters contains so much Glauber's or Epsom's salts or so much lime carbonate, that their constant use is a menace to the health of the individual or the animal that uses it. No hard and fast lines can be drawn relative to the amount of solid residue which is injurious. Very much of course depends upon the character of the dissolved salts, but as most of these salts are eliminated by the kidneys and since the kidneys of Americans are already heavily taxed by excess of animal food and in the elimination of food preservatives, it is advisable, when two possible sources of water are at hand both equally free from decaying matter, to choose the one containing the least sediment. We do not know that hard water is conducive to gout and kidney diseases but there are grounds for believing that such is the case. Water containing much lime or magnesia in solution is called hard water because when soap is added a certain quantity of it is rendered useless by the formation of a white curd before a permanent lather is formed. If, upon boiling, the water deposits much of its lime, the water is said to be of temporary hardness; if most of it remains in solution it is of permanent hardness.

In the last case boiling would not influence the amount of soap wasted, while in the former the loss would be materially reduced. The value of soap wasted in Montana by the use of hard water has never been estimated but it must be high for it has been estimated that by changing from a hard to a soft supply, the city of Glasgow, Scotland, saves about \$180,000.00 worth of soap every year. Hard water also causes extra work in the cleansing of the greasy deposits of soapy lime from wash basins, tubs, and clothes, and in removing the incrustation from cooking vessels and hot water pipes which it tends to fill up completely. The incrustation formed in vessels in which waters containing carbonate of lime is heated, is a bad conductor of heat so, if it is not removed occasionally, a waste of fuel ensues. One authority estimates that 1-6 of an inch of scale necessitates the use of 16 per cent more of fuel; 1-4 inch 50 per cent, and 1-2 inch 150 per cent. In the process of cooking, hard water forms a deposit on tea leaves, meat and vegetables, which hinders their extraction and hardens the tissues. Where soft water is used in making bread it rises better and is lighter in color.

Soda is often used in washing with hard water to overcome the hardness, but the clothes are more or less injured by so doing and insoluble soaps are left in the fiber. On a large scale the use of various chemicals, such as paraffin oil, soda, tar, tannin, salammoniac, caustic soda, soda, and sodium fluoride has been tried with different degrees of success in preventing an incrustation from forming in boilers, but, for general use, no cheaper and better process for softening water has been discovered than that of Clark which consists essentially in adding a calculated amount of limewater and allowing the sediment formed to settle before the water is used. This removes the temporary hardness; the permanent hardness, due to the presence of sulphate of lime, may be removed by adding the requisite amount of soda or caustic soda. Some machinery is necessary for softening water by Clark's process but it is not costly, nor is there any great amount of skill required in its manipulation. The cost is within the reach of most towns and when it is considered that the use of a few cents worth of lime is equivalent to the saving of several dollars worth of soap, it can at once be seen that it is an economical thing to do. Unfortunately, however, it can hardly be applied economically by farmers to their individual wa-

ter supplies, so that there is only one recourse open to them for softening their water and that is the far more costly one of boiling it. Rainwater collected in cisterns is, however, a splendid substitute.

Rainwater percolating through soil and rocks dissolves the soluble earthy ingredients as water dissolves salt or sugar, and it also serves as a vehicle to carry the nitrates, the ammonia, and the mineral food stuffs to plants. Being deprived of these substances its composition is greatly changed. If considerable organic matter is present in the soil the excess over the needs of the plant is dissolved and, if the free circulation of the water is hindered, a fermentation ensues which may be fatal to some plants, such as alfalfa, whose roots are exposed to the action. Such water if collected for home use would contain much dissolved organic matter and may be unfit for household use on account of its taste, odor, or the deleterious nature of the microscopic organisms which it contains. If, however, the water percolates freely into the earth the organic matter and mineral plant food is nearly all used up before the water percolates very far into the strata beneath and the composition of the ground water is changed still more by taking up other mineral ingredients from the deeper strata. The water from the deeper wells is therefore ordinarily free from organic matter and deleterious organisms.

It was stated above that water containing much organic matter might be unfit for home use on account of its taste or the presence of microscopic organisms. By no means is this always the case, for much depends upon the nature of the organic matter and especially the kind of organisms present in the water. One of the best samples of water which I have ever tasted was from the Great Dismal Swamp in Virginia. It was as brown as sarsaparilla from the presence of organic matter but was of splendid quality and formerly was much used on ocean steamers on account of its good keeping qualities. When sewage is present, however, such water is always dangerous on account of the possibility that it may contain the germs of typhoid fever.

In the excreta of typhoid fever patients, even some time after recovery, there is always a living microscopic organism present—called typhoid bacillus—which, when it gains access through the food or water into the stomach, is capable of causing typhoid

fever. New cases of the disease can arise only when this bacillus has gained entrance into the system. Hence, it is of the very utmost importance that the excreta of persons suffering from this disease be kept from getting into drinking water, and it is the fear that this germ may be present that makes us all shun any food or water that may be in any degree polluted thereby. Water is, however, by no means the only food through which the typhoid bacillus enters the body. Any food, utensil, or garment handled by the patient or his nurse may contain the germs, and, if the excreta are not thoroughly disinfected and are exposed where flies can reach it, there is very grave danger that the disease may be carried by flies to the milk or food exposed to them and thus indirectly to the people who are so careless of their health as to allow flies within their home. A little chloride of lime or lime itself should be mixed with the excreta for the purpose of killing the bacteria. The cost of these chemicals is extremely low so that they should be found in common use everywhere.

When it was first discovered that the typhoid bacillus was the sole cause of typhoid fever and that it frequently got into other persons by the use of drinking water contaminated with sewage, the most extravagant expectations were indulged in by bacteriologists with regard to the methods of testing water for the presence of these germs. It was also proposed at once to discard chemical analyses and to rely wholly upon bacteriological investigations if water contained over 50 bacteria of any kind per cubic centimeter it was to be condemned, but no bacteriologist now accepts this limit. There is good reason for this, for if the water contains food ingredients the bacteria soon multiply at a prodigious rate especially when the water becomes warm. It was soon found also that the bacteria were not always present in the water and that it was by no means an easy task to thoroughly examine the water as frequently as it was found necessary. A chemical analysis has one supreme advantage and that is the delicacy of the tests used in detecting the presence of sewage and as it is now a commonly accepted opinion that if the presence of sewage in a water is fully demonstrated by the chemist the evidence is sufficient to condemn the water supply. A full sanitary inspection of water should, however, include three lines of investigation which are, (a) environmental, (b) chemical examination,

(c) biological, including both a microscopic and bacteriological examination. Chemical examination alone would condemn beef tea as sewage while, on the other hand a chemist would undoubtedly credit water, into which a pure culture of typhoid bacteria was placed, as perfectly wholesome and sanitary. The necessity of learning something about the history of the contamination is therefore apparent and when the extreme delicacy of the chemical tests is realized, it will also be apparent that great care must be exercised in the collection and transmission of the sample to be analyzed. A soiled bottle or cork, or delay in shipment may entirely vitiate the analysis.

The use of lime and chloride of lime in sterilizing excreta has been referred to above. This precaution should invariably be taken even sometime after recovery from typhoid fever to prevent spreading the disease, but further safeguard is necessary. All water used for drinking, the preparation of food, or the washing of dishes, especially milk pans, should be thoroughly boiled before use. The germs will multiply rapidly in milk but are easily killed by boiling water. Boiling is usually sufficient for killing the typhoid bacillus but a double safeguard consists in filtering the water through a thoroughly reliable filter such as the Pasteur-Chamberland tubes which are made of unglazed porcelain. This appears to be the only tube on the market which is thoroughly reliable.

It is too often taken for granted that because a well is on higher ground than the cesspool or is somewhat removed from it, there is no danger of pollution. This is often a very serious mistake for the contagion will sometimes travel a great distance even through a mountain as was the case in one instance where the pollution spread through loose rocky material. The danger of contamination may easily be detected by placing a large quantity of salt, some kerosene or a dye stuff in the vault and noticing what effect, if any, is produced upon the water. This test should be applied to every home supply and might well be taken as indicative of the freedom from, or danger of, polluted water. Wells should never be tolerated in thickly settled towns!

The drinking water supply of farm animals is not regarded with sufficient care in all Montana homes, but stock are subject to a great variety of contagious disease unknown to man and many of these find their origin in the filthy water which the

stock have to drink. The various kinds of worm diseases especially are thus spread. The careful thrifty stockman or farmer soon finds that the greater and more rapid gain in flesh and the freedom of his animals from disease soon pays well for the extra trouble in getting and maintaining a good supply of pure water.

When foods or fodders are conserved on the farm for human consumption or the use of the more valuable domestic animals, care is taken to get the purest and best and to take good care of it. If equal care were taken with the water supply, life on the farm would be far more attractive than it ordinarily is and the home workers would be better blessed with health than which there is no boon more precious, and no instrument more productive of wealth.

HOW TO KEEP THE BOY ON THE FARM.

Morton J. Elrod, Missoula.

The cities and towns of the United States are growing rapidly, much faster in proportion than the rural population. This has been recognized for some time, and has aroused great apprehension in the minds of many. The young men and young women flock to the large cities in search of employment, and to know something of the great world in which they live.

Men and women are gregarious. They love excitement. They want to be where something is going on, and to be permitted to take part in it. To be alone is unpleasant, and, indeed, not often to be tolerated. Occasionally a hermit is found who has become a recluse, but the cases are not common. Few will stay in the house alone in the day time, fewer still at night.

Men and women are overgrown boys and girls. The arguments which apply to the older ones will in a measure apply to the younger. The youth has before him a life full of hope, and his vivid imagination pictures air castles which are dispelled only when the angel of death closes his weary eyes after long years of activity as a man. The youth has by the law of inheritance, which he cannot evade, certain natural endowments. These direct the current of his life in one way or the other as they are intensified or diminished by the environment in which he is placed. He feels the want of companionship, the desire to test his natural endowments; he has an ambition to be something and

to do something. The law of the biological world demands that his faculties must be exercised if they develop. He must be rightly directed if the desired end is reached, involving the introduction of those who have given careful attention to cases similar to his. Above all, he is an individual, differing in some way or ways from all other persons on the earth, and must be treated as an individual.

The boy on the farm is early taught to be useful. He must assist in the family duties, for one of the cardinal principles of farm life is to have every one doing something. From doing chores he soon directs his attentions in other channels, and at an early age is filling the place of a necessary hired man to save expense, or because one cannot be secured.

Much of the playday season is taken up by the duties the boy is able to perform, and early in life he looks with sober aspect on the duties of life, and assumes them while yet he should be playing games and having romps with his companions. He reads of the city, that great maelstrom of activity, and his feverish unrest is increased. The brilliant side of city life appeals to him in vivid contrast, and all its horrors, its misery, filth, and wretchedness are concealed from him. His imagination and the great boon of youth, hope and faith in his ability, prompt him to make the change, a metamorphosis of life. Some survive, breast the current and rise to dizzy heights among their fellows. How many sink beneath the wave we can never guess.

The first plain statement I wish to make is that not all boys on the farm will be farmers. This must not be expected. As well expect all the sons of a doctor to be doctors, or of a lawyer to be lawyers, or of a preacher to be preachers, as to expect all the sons or daughters of a farm to be farmers. It would be a strange sight to see a family of children all with the same desires and inclinations. The explanation for this diversity of inclinations is as yet a biological problem. We have to deal only with the facts. Because a father is a farmer, or a lawyer, or a teacher, is no reason at all why a boy should take up that occupation. The mental aptitude of the boy, his desires and inclination, should be the great determining factor in selecting his work for life.

Youth is the time for play. Play has greater psychological

and educational significance than has usually been attributed to it. Play is universal among animals, and is a necessary adjunct in connection with mental and physical development. Play is not necessarily for youth, but youth is for play, in order to develop the physical and mental side in the logical and natural way. It is by the use of the willing, rather than the unwilling attention. To eliminate play is to take ground opposite to that recognized as necessary for development by a study of the animal world. Play is not entirely eliminated, but is too often reduced to a minimum for the boy on the farm. It is not uncommon for the boys to sneak off to a back pasture for a Sunday game of ball, or to take a bath in the creek by the light of the moon when he should have a swim free from restraint. Little wonder that he steals off to the hay mow on rainy days with two or three others if stimulating mental games are not supplied. Perhaps he goes to extremes on nickel libraries or other trashy literature because he is not supplied with reading matter which appeals to him. It is no more work to chop wood or build fence than to play tennis, and far more utilitarian, therefore the latter is not indulged in. Why should he waste time in play when he can work, learn the business, and get ready to take the farm or the store off father's hands?

The period of infancy for man is fixed by law at 21 years. Some reach maturity before they have attained their majority; others need a guardian all their lives. During this period of infancy the individual should be given his preparation for life work, and should be so treated that all his mental faculties shall be developed. During this formative period his peculiarities will appear, and his inclinations become apparent. Play, the forerunner of work, develops or brings out these natural gifts.

It is for the parent to direct the boy so that he may enter the race with a fair start. He does not have a fair start, but is badly handicapped, if he is forced daily into work which he finds no interest in, whether it be on the farm or in the shop or in the office.

The boy's love for the farm is often killed by long hours of work and unnecessary and illogical strenuosity. The strenuous life has frequently been dwelt on as necessary to the success of the individual and the nation. Enforced strenuosity produces physical torture and aneurism. To a boy it is a living death. True, it is necessary to a limited extent, and in its school have

developed many of our best leaders in educational and political life. But they broke away as soon as possible.

A recent editorial in the Butte Miner expresses the same idea in the following words:

"The desire of boys reared in the rural districts to leave the farm and repair to the city has been widely deplored by writers on political and social economy; and the concensus of opinion expressed has been that home life in the agricultural sections should be made more attractive to youth.

"In discussing a phase of this subject at the Monroe county fair, in New York state, a few days since, Governor Odell expressed himself as follows

"That we have too often looked upon the toil incident to farming as mere drudgery, and that perhaps unwisely, by too early putting the boys to work, we have instilled in their minds a distaste for farm life, is beyond question. Our laws have been framed to prevent the too early employment of the young in our manufacturing pursuits, and if the same consideration were given to the boys upon the farm there would be less of attraction in the glamour of city."

"The chief executive of the empire state is correct in the conclusion that the boys should be protected from the drudgery of farm life, and that laws which prevent the employment of those of tender age in factories and other industrial vocations of that type should be made to apply to the farm.

"While farmers are as solicitous for the welfare of their children as any class on earth, and while they would rear them as tenderly and give them the benefits of the best parental care, the idea is a prevalent one that these ends can be achieved only by the rigid discipline of toil.

"Moreover, the average farmer feels the necessity of pressing into service all the available help possible at the least expense, hence children are first educated in "doing chores" and graduate at an early age into the heavier drudgery of the farm.

"Much of the playday season of the farm boy is destroyed by the urgent demands for the labor he is able to perform, and to many youths thus environed the world takes on a most sober and serious aspect at the very threshold of life.

That this regime in some cases has been beneficial there is no room for doubt, inasmuch as the rural districts have furnished

some of the noblest and best and most efficient leaders of public thought in every walk of life, and there are few of the more prominent men of today who have not served a term, as it were, behind the plow.

"Nevertheless, as averages go, farm life should be surrounded by more attractions, and the vocation of agriculture would assume greater dignity in the eyes of the youth, did not its labors fall upon the mind before their utilitarian features can be recognized and applied.

"This leads to a weariness of mind and body that finally develops into a distaste for farm life and practically drives the boy into new environments, in the hope of bettering his condition.

"It is not necessary that the home life on the farm be given all the embellishments that are more easily attained in the city, but that the natural tastes and qualities of the youth be allowed to develop and ripen along their proper lines, rather than be cramped and stunted by the drudgery too often imposed upon him.

"The problem of educating the farmer boy to love the farm, and to appreciate the possibilities of the vocation of his sire, is one of growing importance to the American nation, for the tendency of the times is to mobilize the young manhood of the country in our cities and overcrowd the various professions incident to municipal life.

"Governor Odell is entitled to commendation for his many words in touching upon this subject, and it is to be hoped that the influence exerted by that executive may be widely felt throughout the nation along these lines."

The remedy for this evil is shorter hours for the boys, more frequent holidays, less arduous and exacting duties until the weight of years brings corresponding ability.

Another difficulty, hinted at previously, is the lack of reading matter in the home. This applies not only to the country home but to the city home as well. In the city there is usually the city library, where current magazines and periodicals may be read, and where choice books are to be found. In the home on the farm these must largely be supplied by the family. A child who goes to a school presided over by a modern teacher will want to read good books and papers. If he cannot be supplied with good ones he will possibly seek cheap trash. Daily news-

papers and dictionaries or encyclopedias are not sufficient for the average boy and girl. There must be juvenile literature, applicable to his thinking, and of such a character as to appeal to his better nature. One or two good juvenile magazines, should come to every home where children are being raised, and several suitable books should be purchased annually. It is not expected that a lavish expenditure will be made for current magazines and books haphazard. The selections should be carefully made. If parents are not posted on what is suitable they should ask advice of those who are supposed to know.

Money making is not all of life. Money is an important item. To some it is the all important thing in life. Unfortunately the desire to amass wealth has turned the heads of half the nation. Education is not worth having if it cannot be turned into dollars and cents, they say. A study is useless unless it has some immediate practical utility. Fortunately few of our boys and girls are filled with this burning desire for gold. They like spending money, it is true, but their greatest desire is to see and to know more of the world. A boy will risk his life under an electric car to see its works. He will ride a break beam to see neighboring towns. He will tear a machine to pieces in order to put it together again. He will work months for a few days off to visit the fair or a neighboring town.

The farmer boy sees less of the world than his city cousin. He sees less than his share. Possibly he may see as much as is good for him, but that does not satisfy. If parents would more frequently take a day off and go fishing with the boys, or tramp with them through the woods, or direct them, or at least sympathize with them in their sports, there would be less dissatisfaction, more cheerfulness in the work in hand, and days added to the latter end of life of both. Hunt with the boys, fish with them, drive with them, take them on occasional journeys, read with them, sympathize with them in their boyish troubles, lead them by counsel and by deed, always mindful of human weaknesses and individual peculiarities, and there will be more contented spirits on the farm when manhood is reached.

I knew a man who expected his boy to know the ancestry of the animals on the farm from the pedigree stock book. It is very doubtful if there was a pedigree book showing the boy's lineage. Which line of descent is of the greater importance,

that of the boy or that of a cow? The time will come when the boy will be interested in bovine genealogy, but in his earlier years it will have little attractions for him.

The services of the boy are frequently held in too light esteem as compared with those of a hired man. The boy is one of the family, and therefore is expected to work gratuitously; for, does he not get his board and clothes, his schooling, his spending money, (if he has any), all the necessities and possible luxuries that go with his home life? Considering this, it is often thought he gets his full share. Let it be remembered that the boy was not consulted in the matter at his entrance into the world. His opinion was not sought as to what he is to do in early life. He was born on the farm, reared on the farm, put to work on the farm, and held there, not because he sought it or asked it, but because it was given him without choice. A hired man sometimes works from choice, sometimes from necessity. He may quit when he is dissatisfied, no matter how bad he may leave the condition of the farm, and not matter how critical the time, and go elsewhere. But the dissatisfied boy is likely to have his jacket dusted and forced to continue the distasteful work.

What is the remedy? Let the boy have an interest in something. Give him something that is his, and let him use his brains in making it a success. In the ordinary family the farm reverts to the boys and girls at the last, when they may do with it as they please. Why not begin early in the game, and let a portion of it be used at their discretion, when a guiding hand may be used in showing the right way? More work will be done, and it will be done more cheerfully. Plans will be laid for completion of work so vacations may be taken, late hours will be indulged in so that a day may be taken off, and it will be done cheerfully and without grumbling. A boy's most cheerful work and most honest effort will be given to something that is his own. Every boy should have something to work at in which he is given an interest, and where he may plan, work, and decide for himself. What this is must depend on the parent, the desires of the boy, and the farm.

Let me repeat, the boy's inclination should be consulted. It does not follow that he must have everything his own way. Continued forced labor is distasteful to any one and there must come a time when there will be a rebellion. The lad with his life

before him and with his mind filled with hopes and ambitions will not shoulder burdens like a man, but will flee from the hated tasks, trusting in his guiding star to get rid of them. An antagonistic spirit is hard to handle. Every teacher knows this to be true, and the great problem is how to make the appeal so that distasteful work will be done and done conscientiously.

Discipline is an important element in any successful life. One must drive himself to tasks he thoroughly dislikes, and must do them as carefully and as well as those things in which he takes most active interest. To work against great odds and yet win is a great achievement in any life. To be under thorough discipline and do a thing because it must be done to carry out the general scheme is ideal in any man's work. This is one of the cardinal virtues of the great American game of football. It is the secret of many a man's success.

For gaining such discipline there is no greater school than the farm. This is what has given to the world such sturdy leaders in war, in letters, and in science as have made the world famous. This is what will yet do wonders in the years to come. And it is this discipline that hurts the boy, but it cannot be avoided. It can be reduced to a minimum by making it willing rather than unwilling. Hence the great necessity for advice.

Help from those who make a study of child life and boy life is a great necessity. Often a word from a stranger is more effective than from a parent. How often to teachers comes the cry, "can't you talk to my boy and do something with him?" I fear it will sound harsh if I say it, but say it I will, that parents do not talk to children enough, do not take the boys into confidence, do not let them put a finger in the pie, and the result is a general misunderstanding. Take the average boy of American parentage, talk to him right, and I believe he can be led to the gates of heaven or the jaws of hell, as suits the leader.

Hence the great need of education, inspired by persons of lofty ideals, and continued from the cradle to the grave. No one can remain in a given condition. To be inactive is to go backward. To make progress requires constant effort. It is a battle from start to finish. Brute force no longer rules. The man of brains is as necessary on the farm as in the physician's office, the merchant's store, or the professor's chair. Nowhere is there more urgent need of men of brains than on the farm. From a finan-

cial standpoint brains put into the raising of crops and feeding of stock is as remunerative as in the professions. This is recognized by the government of the United States in its liberal appropriation for agricultural colleges and experiment stations. A thousand men in the United States spend their lives in experimenting to aid the farmer, and without expense to him. More than eight hundred persons spend valuable time in preparing addresses for the farmers of the United States in the different states through the Farmers' Institutes, almost all without compensation, and without expense to the farmer. Unselfish men spend their lives in this work of aiding the working man that his work may be more profitable. Should not the farmer do all he can to help himself and his children, by becoming acquainted with the work of these men, and by giving to the boys that liberal education which will develop their mental faculties so they may grasp fully the scope of the work, and may apply the suggestions in every day life?

John Hamilton, Farmers' Institute specialist at Washington, in a recent letter, says "Many farmers unfortunately, do not read the agricultural literature prepared by the colleges and stations and by the department, and are, therefore, almost entirely ignorant, of the efforts that are being made to assist them, and of the scientific facts that are being collected at so much expense of time, money and effort."

But with all the farm literature and bulletins from experiment stations there is vastly more written about how to feed the hogs or the cows so as to make them do what is wanted than there is devoted to the boy or the girl. It would appear that any old way is good enough in raising a boy or girl; there is no special need of proper nourishment for the production of brain force, any kind of food will produce that; the chickens must have a scratching pen, proper food to produce eggs and shells; the cows must have a mixed ration thus and so to produce milk in proper quantity and richness; alfalfa must have proper soil for nourishment and bacteria inoculation if a satisfactory crop is reaped; a bulletin has even been written on how much meat ducks should eat; careful tests have been made on how much Paris green is necessary to save the potato crop; but how many bulletins are written on the boy? How many vacations per year will save him to the farm? How shall he spend

his first ten, twelve, or eighteen years so as to get the most in his head for after use? What kind of a teacher should he have in the schools when his character is formed? What should be the kind of companionship to encourage? How much money does he need to spend as he pleases? How many books should he read per year, and what should they be like- How much schooling should he have? These and many other questions must be answered before we can give an intelligent answer to the question "What shall we do with the boy?"

ROADS AND HIGHWAYS.

PUBLIC HIGHWAYS.

By J. M. Burlingame, of Belt, Montana.

When the farmer has his crops secured and is about to move them to market his first thought is about his road. What is its grade? What is its distance? What is its condition? It is a trite saying that a chain is only as strong as its weakest link. It may as truly be said that for the moving of farm produce a road is only as good as its hardest pull. A farmer when loading for market takes this into consideration and knows that he must load only for the hardest pull. If the hardest pull means only half a load this must be his limit. When this is the condition he must make two drives to and from his farm to move one load of produce to his market. Here then the condition of his roadway has doubled the cost of transportation. This alone may, and in many cases does, wipe out a small profit and substitute in its place a positive loss. Three essentials of a good road are an easy grade, good workmanship and a direct line. An easy grade and good workmanship are absolutely essential to a good road. Mere difference of distance when not too great may be most profitably sacrificed to the securing of an easy grade. A farmer will willingly and profitably go a few miles further to haul a full load rather than go a few miles less when he can haul but half a load. In fact he will go a few miles further with a full load over an easy grade in less time and with less wear and tear to his team than he can go a few miles less with half a load over a heavy grade. This principle is constantly applied by our great railroad companies who are always on the lookout for the cheapest haul. Several great railroad companies are at this moment looking for roadways over this state. The best engineering skill in the world is found and paid for and months consumed to find the easy pull. Millions are to be saved by this carefulness in securing the easiest pull. When this is found a road will be built with careful and consummate workmanship.

These two precautions of an easy grade and good workmanship save wear and tear of cars and engines and hauling power, and miles in length are readily conceded to secure an easy haul.

The farmer understands the correctness of these principles of transportation just as well as the great transportation companies do. He knows that they apply to his own haul in proportion to its length and weight, precisely the same as they do to the great railroad companies. He knows that steep grades and bad road beds are just as destructive to his horses, harness and wagons and as ruinous to his prosperity as steep grades and bad roadways are destructive to the engines and cars and ruinous to the finances of the great railroad companies.

A heroic and masterful struggle is being carried on at this time by our president and many non-partisan patriots of all parties to secure just and equitable freight rates from our railroads on interstate commerce and millions of patriotic Americans are endorsing and urging on the grand work. Yet the men of Montana are at this time sleeping upon wrongs which are easily within our power to remedy that are costing us each every year more than all the wrongs of the railroads which are now racking a continent in the struggle to remedy them. I mean the loss to a multitude of our farmers from our despicable highways. A leading merchant of Belt came out to my ranch last summer and while at my house said to me: "I have heard of the miserable roads out this way but I did not think it possible they were so bad." And yet sleeping upon these great wrongs we are crying ourselves hoarse about freight rates.

Let us wake up. It is morning and the fields are already white for the harvest. We have only to enter and work. The reward of our labor is sure.

The three great things essential to the farmer's success are good farming, good roads and good markets. The first essential of good roads is a good system well administered. What shall we say of our system? We do not ordinarily call a system good that gives a man—or three men—two or three times as much to do as they can attend to. And yet that is what we are doing in this state. In the first place our county commissioners have the public business affairs of 30,000 people to attend to. That duty alone in a new country making its improvements and erecting its

public buildings is immense. In addition to this they have the oversight of all the highways in this county. How little do we conceive of the immensity of this duty. In many of the counties of Illinois and other states there are roads on every side of every section of land. In this county there are 2,764 square miles of land. If we had roads on only one side of these, that is no cross roads, we would have 2,764 miles of road. Miles enough to reach from San Francisco to Washington, D. C., and from Washington to New Haven, Connecticut, and while we shall ever have roads along one side of all these sections who shall say that the additional difficulty of mountain road building shall not require an equal amount of skill and supervision that the same number of square miles in Illinois or Minnesota, and yet the same system applies to counties in this state to which this county is like a cupful in the bottom of a bucket. Take Chouteau county with its 16,049 miles. This would reach in a straight line six times from San Francisco to Washington, D. C. As with the county supervision, so with the road districts, they are immensely too large.

This is the system; what of its administration? Men who are charged with the business administration of 30,000 people will lack the time to administer it if they have the qualifications. They may have the qualifications, but it will be an accident if they do. Too often county commissioners are nominated and elected from points in the county upon partisan issues, for partisan purposes, where it is thought they will balance up the party ticket to help party success. This is the result no matter what party succeeds. Having your commissioners elected they move into the political center of your county and begin the administration of their office. Now we begin to look for results. What do we find? Three belts of territory: One of good roads, a second of fair to indifferent roads and a third of no roads. This naturally results from inadequate supervision through too enlarged duties with the county a territorial unit for road work, with the administration located in, and the funds all disbursed from the center of the county. What the commissioners see they know, and they see what is before them. This is near the county seat and what lies between the county seat and the homes of the respective commissioners. Here the roads are generally good. Next comes the belt of roads that are

partly good and partly bad. This is the belt that surrounds the good roads. Here the conditions of the roads depend upon how persistently neighborhoods owing to the greater or less nearness to the county commissioners can press their claims for betterment upon the commissioners. It of course also incidentally depends upon how much intelligence the supervisors appointed by the commissioners exercise in doing the work they undertake and upon the size of their road districts. It must be confessed also that the supervisors are far too often appointed upon petitions partisan in their character and without regard to the qualifications or lack of qualifications of the applicant.

The third belt is where roads are entirely wanting. This lies outside the second belt, it is up among the foothills and on the last benches next to the mountains. This is the territory that has long been credited by our promoters with raising the best unirrigated crops that the state produces. And yet for years its has been allowed to raise crops that it is unable to market for the lack of roads. Yet these people are all paying taxes that are used to build roads elsewhere. This is the inexorable working of the system. Observe a single illustration of the condition in one of these outlying tracts of the county. You may start at the Great Falls Highwood road near the north line of the county and travel south to Kibby, a distance of 25 miles, and you cannot get a road a rod of the way except where you cross a few less than half built stem roads that run up toward the mountains. Your whole journey will be across farms on by-ways as bad as can be imagined—rocky, all stumpy, muddy, sliding, steep, washed out and broken—where every accident to which man and beast and wagon and load are liable must be constantly anticipated and guarded against and where the byways of yesterday may be obstructed with barbed wire fences today. This road system with its stub end roads stopping before they reach the grain fields of the outer bench land and foothills, in their ugly deformity, may well be compared to a fruit tree cut back below the flowering and the fruiting ends. It shows only ugly stubs cut short of the indescribable loveliness of its fruitage. This is what our road system gives the farmers of the foothills, namely—nothing.

But much of the attempted work is not commendable. It does not require an expert road builder to know that a road

should not be scooped down in the center instead of arching over, or that a gutter on the inside of a grade should not be higher than center of the road, or that the gutter should be so shallow that a cowtrack will turn the water from the gutter into the middle of the road, or that a down grade of half a mile should not have a single passage for water from the gutter inside the grade to the hill slope outside the roadbed, or that the abutments of a bridge should not be laid upon the rolling stones at the side of the creek, and yet there are miles of such road in this state and there have been such abutments built; presumably, of course, unknown to the commissioners of the different counties. This fact only gives strength to the demand that these be given less general and more local supervision and care than the present system of making an entire county the until of road work.

What must be done if farmers are to live and prosper in this state is a big change of road system and a change of road administration. What the system shall be it is useless here to elaborate, but it must be a system that gives the outlying bench and foothill districts the money for and administration over the local road districts. Under the present system money may be taken from Grafton and expended at St. Peter's Mission, or it may be taken from Hepler and expended on Davis creek, places so far away from each other that the existence of one place is not known to ten per cent of the inhabitants of either of the other places. Agricultural prosperity is impossible under such conditions.

Perhaps a combined system of county trunk lines under county commissioners and local township roads under town officers would meet the requirements. Such a system worked well in New York, New England, Minnesota and other great prosperous states before the Montana plan was invented; an improvement that does not improve. In any event the system adopted must be one that gives our proportion of work out among our mountain farms at places where we have not seen a road officer in the last eight years. Either this, emigration, or county division. Something to lift from our backs the present baneful conditions and give us instead thereof decent and tolerable roadways.

Let it be distinctly understood that we are not here making war against our road officials in Cascade county. We now war against the wrong of a system. It is a state wrong, not simply

a county wrong. Listen to this from an old time resident and prominent farmer of Missoula county, uttered through the Rocky Mountain Husbandman. He says: "In fact with the exception of Flathead county I do not believe there is a county in the state properly laid out with common roads, let alone good ones." Is it a credit to Montana or an encouragement to immigration that such a thing can truthfully be said? Where are our friends of Montana and of its prosperity and its growth who will suffer such a statement to be truthfully made without lifting hand or voice to remedy the wrong? Are they slumbering at home? Or are they possibly junketing outside the state for immigration? Will they bring their homeseekers to the bench and foothill lands of our mountains and say to them, "Here are our most productive lands. Grains and vegetables grow luxuriantly here without irrigation. Only one trivial thing is lacking—roads to get your produce to market. But while you do not enjoy the privilege of roads you are granted the privilege of paying highway taxes. Here, and there are United States government forest reserves where the government will pasture your cattle and horses and sheep for a song. Thousands upon thousands of horses and cattle and sheep can find the most luxuriant grain here that will prepare them for the shambles, equal to the corn fields of Illinois, Missouri, Iowa and Minnesota. Here upon the forest reserves you can get poles for your corrals and timbers for your barns and sheds through the free gift of your government. Hundreds and thousands of farmers can be accommodated here. Only one simple thing is lacking—roads so that it is possible to get onto the reserve with your cattle, horses and sheep and get off with your timbers and poles. But you are permitted to be taxed for the roads."

Under Montana's road system and its administration this condition has existed in much of our bench and foothill lands since their settlement and good farming communities have sprung up and entire school districts populated and created that have never been visited by a county commissioner and the voice of whose united cry has been unable to reach the distant ears of the center of the highway authority and of highway administration.

How are we to secure the much needed, in fact indispensable change of system and change of administration. There is but one answer; by the thorough organization and united

action of the farmers of the state. We must with an united voice make the reasonableness and necessity of our demands apparent to the representatives of all our fellow citizens of the state when they meet in the next session of our legislature. How can we make our wishes apparent? Through a representative farmers' congress to be convened at a convenient time and place in the early summer at which congress we shall have represented every farmers' association in the state and there discuss and determine our wishes and need and then through a proper and authorized channel present them to our next legislature. Such action supported by the active and strong arm of united agriculture is our only resource. All weak, disjointed, isolated action among farmers will be worse than puerile, it will be imbecile. Our course must be that of active, brave, united, vigorous and determined manhood. Can we rise to the manly level and accomplish the essential work? I know not. But if this fails us all fails us. Present conditions cannot last. Men cannot forever farm at a loss. I care not how rich the land, how bountiful the harvests, how numerous the herds, if produced and marketed at a loss the condition cannot endure. Under such conditions the more we produce and market the poorer we are and the less we produce and market the richer we are. If we can do good farming and secure good roads over which we can reach good markets we can stand, otherwise we must fall.

A PLEA FOR GOOD ROADS.

By Prof. E. Tappan Tannatt, Agricultural College, Bozeman.

Very few people, who have not made a study of the question, realize the sum total of the vast amounts annually expended in the several states for road improvement, and the small value received by the expenditure. I regret that my comparatively short residence in the state has prevented my compiling these figures pertaining to Montana conditions. As I propose to refer largely to the work done in other states, I take the liberty of extracting from Bulletin No. 6 of the Engineering Department of the Iowa Experiment Station. I believe that if conditions were investigated in the State of Montana that the figures given showing the efficiency of the past method of expending the Road Fund in the state of Iowa would not miss very far the conditions in Montana. The Bulletin states,—“In 1904, in addition to the poll taxes and sums raised from other means than direct taxation the great sum of \$4,456,033.98 was raised in Iowa for road purposes. From this sum of money great results should have been secured. It is doubtless honestly and faithfully spent by the road officers of the state, but these officers are not trained road builders and have had no opportunity to receive instruction in the principles of scientific road constructing. Hundreds of road officers have expressed to us their helplessness, under the present conditions, owing to lack of system and to lack of trained road builders to do the work. In one case an experienced outside road builder made a careful estimate for us of the true value of the grading done one season in one township as \$50, yet \$1,000 was actually spent in the work.”

Let us see what might have been accomplished in Iowa in 1904, without additional taxation.

“In the first place, \$1,000,000 could have been set aside for the construction of permanent stone and gravel roads. At the prices for which such roads are actually being built in Iowa, this would have given us 350 to 500 miles of stone road, or 1,000 to 1,500 miles of gravel road in one year. In the second place, \$750,000 could have been set aside for grading (building good, substantial grades and side ditches, in accordance with a road engineer's plans) and at prices at which such work was actually let by contract in some counties in Iowa, this would have moved 7,500,000 cubic yards of earth. In the third place, \$300,000 could

have been set aside for dragging the roads with the King Drag. This would have been sufficient to drag every mile of earth or gravel road in the state. There would have been left \$2,400,000, besides poll taxes, for general repairs, bridges and administration."

It was the compilation of such data as the above and the placing the same before the people of the state that caused the legislature to organize the State Road Commission, and the subsequent compilation of road laws and regulations that have attracted the attention of all those interested in good roads, and has given to the state of Iowa a system well worthy of being followed by other states, including Montana.

Road construction is rapidly becoming a business of its own, and the engineer recognizes in the future a grand possibility for specially educated civil engineers. The United States government, recognizing the value of good roads to the development and wealth of the country has organized the Office of Public Roads. In the last report of the Secretary of the Interior, we find that the Office is attempting to educate engineers specially for road construction, and for this reason is asking the co-operation of the agricultural colleges and offering excellent possibilities to the graduate civil engineer.

A graduate from the civil engineering schools, after competitive examination is given one years' schooling in the Washington office and in practical road work, with \$50 per month. After this time he is given a diploma and can continue in the service of the road department or have the benefit of the additional education for civil life.

The Montana Agricultural College, recognizing the necessity has added a course in highway construction to the civil engineering course and the next short course, or winter school will also contain study along this line. The government and the state educational institutions are alive to the conditions and the necessity, the people of the state should realize that only by united and systematic effort can the best results be obtained. A very large number of the road supervisors of the state who are anxious to do the very best they can for the county and state, not only lack the education but the united effort necessary to produce the required results.

The legislature of Iowa and other states have appointed a road

commission to systematically investigate the conditions of the state and to advise the best methods of construction and recommend the laws necessary to secure the very best results. This commission is composed of the men in the state, who by education and experience are best able to handle intelligently the question. Annually the commission travels through the state, or certain portions of the same, holding schools in road construction and advising methods to be used. Local conditions are investigated and the geological conditions of the state studied with a view of road construction.

At the present time there seems to be a growing demand for better wagon roads. The people realize the inconvenience and expense of the present roads, and the poor returns received for the money expended. We are all ready to advise new methods of construction or to condemn the work of some neighboring supervisor, but I believe that we are missing the key to the situation, in not demanding of the legislature the passage of such laws as will enable the state to receive the same economical advantages which are being enjoyed by other states. We would question the sanity of the management of a railway which would intrust its construction to the same system used at the present time in the expenditure of the money annually paid on county wagon roads. Yet we seem to be satisfied with the plan when applied to public expenditure.

The writer is much interested in the betterment of public roads, and believes that it is one of the most important problems which should take the attention of the legislators of the state. The Experiment Station is, so far as in its power, willing to assist in pointing out better plans of construction, locations, etc., etc., but believe that it is a more or less hopeless task, so long as the unsystematic and unbusinesslike methods of expending the public money are allowed to continue. We earnestly trust that the newspapers of the state, will see the question as we view it, and commence a campaign for legislation along the lines which have proven so satisfactory and economical in other states.

The general demand for good roads can be somewhat realized when the Secretary of the Interior reports that the office of public roads is unable to secure sufficient young men who are specially educated in road construction, to take charge of the work which the office is carrying on in the several states of the Union.

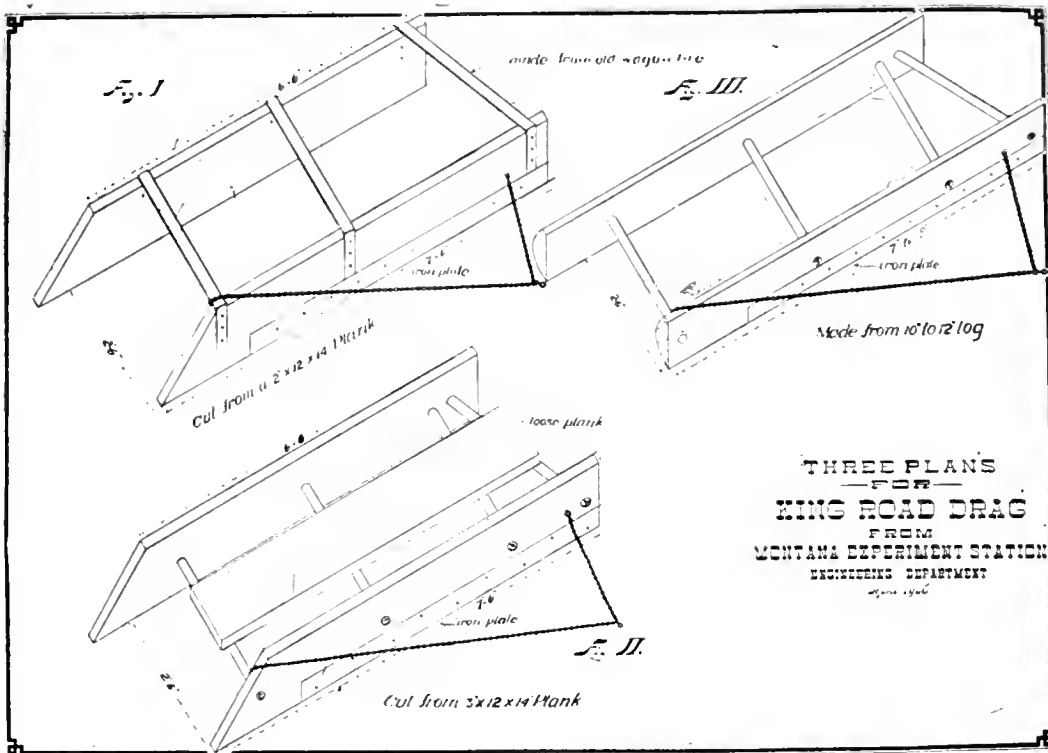
With better road laws, and with systematic and conjunctive action, the money which is being expended in the state of Montana, if used for scientific road construction would accomplish wonders for the state and young men who could be educated to take charge of this work and assist in pushing the good work along, would be able to make an enviable record for themselves, which under the present system is impracticable.

As an illustration of the failure of properly educated and directed endeavor; a short time since we received a publication advocating the use of the King Road Drag, and giving a picture of the same together with directions for constructing. Upon examination of the same it was found that although the machine would in many ways resemble the King Drag, and to the casual observer would have been pronounced such, at the same time the very element of the success of the drag had been omitted. If our road supervisors had followed the instructions given they would have beyond doubt pronounced the drag a failure, and would have been one of the men who would do much to prevent its use. The publication was sent out with a view of doing good, and the effort should be commended, but on account of lack of proper knowledge of the principles upon which the drag is constructed the publication would without doubt have resulted in a direct injury to the cause.

A short time since when in Billings, I observed a "split log" drag which evidently had been constructed and used as an experiment. The machine lacked the same points which were omitted in the publication referred to, and was laying beside the road evidently abandoned.

The making of the drag showed the right kind of spirit and the appreciation of the necessity. Unfortunately, however, whoever the maker was, had either received a publication similar to the one referred to, or had failed to recognize the principle of the machine. What is needed at the present time is systematic endeavor, and a fountain head, from whence the supervisor may receive information which will be as it should be.

We therefore trust that the advocates of good roads, instead of spending their time and energy advocating methods of construction, or the practicability of some special machine, will combine to secure the enactment of such laws as will make possible the good roads which should exist in the state of Montana.



THE KING ROAD DRAG.

Some twelve years since a farmer by name of D. Ward King, then living in Missouri, desiring to better the condition of roads in his community constructed and used what is now known as the "King" or "Split Log" drag. In that state his work attracted the attention of the Secretary of the Missouri State Board of Agriculture and Mr. King was prevailed upon to join the institute corps and travel throughout the state, explaining the use of his drag. In 1905, through the influence of the Iowa State Highway Commission, Mr. King was furnished with a special train and traveled throughout the state of Iowa spreading the gospel of the road drag and good roads. The Iowa State Highway Commission, speaking of the drag and its work, state; "We have carefully tested the road drag by actual trial and we strongly endorse its use. There is no reason why the road officers themselves should not take it up and do the work from the road funds, by hiring men to care for sections of roads each few miles long. We advise the farmers to start using the drag without waiting for the road officers to take it up. We also advise the road officers to adopt the road drag, and to provide farmers with free materials to make them, and to hire the roads dragged where the farmers do not themselves undertake the work. There is no

possible use of the road funds known to us which will yield so great returns for so small an outlay."

From the Mayor of a city in Indiana we quote the following:

"About a month ago I received word that the Northwestern railroad would bring D. Ward King to our city. I heard Mr. King at St. Louis, and when I received the railway poster I immediately made a drag, building it precisely as directed. I finished it before noon and put it to work at one o'clock on a single block of our main street. The soil is gumbo and the street was almost impassible, the mud being hub deep in some places. We put the drag right into the mud and kept it going. At five o'clock, just four hours after beginning to use the drag, wagons loaded with forty hundred (4,000) pounds of bailed hay were being drawn over the block and were making a scarcely perceptible rut. But when they went over the crossing the wheels sank nearly to the hubs in the mud. Our people are thoroughly convinced that the drag will revolutionize the method of caring for earth roads."

The theory of the use of the King or "Split log" road drag is very simple, and the machine is designed to fill a want not met by the road grader or kindred machines. The road drag is intended to operate at its best when the condition of the road is too wet for the successful use of the grader. In Earth road construction, drainage is recognized as being the secret to success. Water is the greatest enemy to earth roads, and must be removed from the sides and foundation as well as the surface as quickly as possible. In order to accomplish this result the surface of the road should be crowned or rounded, so as to turn the water into the gutters to be carried away from the line of the road. If the road is rutted, the ruts form pockets, or small reservoirs, which hold the water, which in turn softens still deeper the foundation, permitting the formation of excessively deep ruts and "mire holes."

When the surface of the road is in a muddy condition, we observe that if it is smoothed and the water permitted to run off the travel tramps the surface making a good, hard roadbed.

Unfortunately most of our work upon the roads is done at a season of the year when the assistance which the rains give is not taken advantage of, leaving the new surface in a rough condition, subject to rutting wheels, dusty, and in a most excellent

condition to become as bad as possible when the rains commence.

The King road drag is intended to be operated immediately after the frost is out of the ground, or after a rain. In addition to preparing the road surface to receive the next rain, the action of the drag also distributes the puddled earth over the surface in a thin layer, and fills up the ruts; this is compressed by the traffic into a very hard surface. Successive use of the drag, produces a very hard surface of considerable depth, which is as impervious to water as it is possible to make it; even better than the surface produced by the road roller, as it is more compact near the bottom layers.

In referring to the plate showing three forms of the King or "Spit log" drag, Fig. I, represents a form of drag made from one three inch plank 12 inches wide and 14 feet long, three pieces of old wagon tire and an iron plate one quarter of an inch thick and five feet long.

Fig. II shows similar design made without the use of the iron tires.

Fig. III shows the design of the Split log drag, made from a log 12 inches in diameter and from 7 to 9 feet long.

The drag is designed to be used when the roads are "muddy." After each rain drive up one side of the wheel track and back on the other side at least once, with drag in a position to throw the earth to the center of the road. Ride on drag. The position of the driver and the length of the chain will materially influence the action of the drag, as will be discovered by trial. Gradually widen the strip as the road improves.

To round up a road better plow a shallow furrow occasionally on each side of the dragged strip, and work the loose dirt to the center.

In making the drag, notice that the iron plate on the front plank does not extend the full length of the drag. This permits the mud when it reaches the end of the plate to pass under the edge of the drag. The distribution of the mud is also facilitated by the form of the tapered end. Except in the case of the Split log drag the ends should not be cut square off as by so doing the material will be deposited in ridges near the center of road and the desired result not secured. The rear plank should not be shod with the iron plate, as this plank is not intended to cut the surface.

Where the road is wide as in a city street, commence at the gutters and work to the center by passing backward and forward through the length of the street.

The cost of constructing the King or "Split log drag" ranges from seventy-five cents to \$4.00.

FIELD CROPS.

ALFALFA GROWING.

By W. W. Wylie, of Bozeman, Montana.

I have noticed during yesterday and to-day that the discussions have taken the form largely of legislation: What can we do to get our products sold? I come before you to represent a subject that does not need any legislation; we are not asking for any laws on the subject of Alfalfa; the consumers of alfalfa know the product, and know the kind of adulterated product, and will pick it out of any number of the adulterated products you can put before them; there is no other kind of hay, nor feed of any other kind that you can put before them that they will be induced to eat because of a different label, but they will pick out the real article and consume it without any trouble and with good results. In taking up the subject of alfalfa growing I will first mention the headings under which I will discuss it.

First, the ground adapted for alfalfa, then the preparation of the ground; the time to sow and the amount to sow; watering the crops and cutting back the first crop; when to cut and how to cure; how to stack and how to feed; how to feed different crops; pasturing; disking alfalfa and the difficulty of reseeding it; the question of bacteria in the soil; and how long a field will last.

I might say something first as to the value of this fodder as a feed product as compared with other hays. I don't think there is any question in the minds of those here who are interested in alfalfa but what it is the best product for fattening or growing young stock that there is. It is much better than clover and certainly much better than timothy. Most of our lands in the Gallatin Valley are now too valuable to raise timothy; the returns from an acre of timothy are so small, and the destruction or the hardship that it works upon the ground is such, that very few farmers want to raise timothy who are near our markets. We don't grow timothy to any extent in the Gallatin Valley, but we mix clover and timothy together to feed the horses. The

quantity per acre is better. We are raising very much more clover in the Gallatin Valley than we are alfalfa, and always will, chiefly for the reason that clover is raised there to enrich the soil and fits better into the rotation. We are going to have a lot of hay left this year, but none of those farmers who have clover hay left are discouraged about raising clover. If they would have to burn the product that they have left, they would still consider that it was valuable to raise clover, and will go right on with it the next year. We raise clover two years and then crop our ground to grain two years and then clover two years again, and in this way our ground does not deteriorate but keeps up its fertility and keeps clean.

Now, as to Alfalfa. The ground best adapted is bare bench lands. In talking on this subject in the northern part of the State last winter, the question came up about dry land farming with alfalfa. We encouraged them to try alfalfa on their dry lands, because it will grow wherever you can raise a crop of grain. It may not grow as profitably or as large crops compared with the way we raise it under irrigation, but people, who have tried it find that they can get one good crop of alfalfa and then fair pasture afterwards, and it is good to seed on some of those lands where the wind is carrying the soil away from the other crops; as the alfalfa holds it and will renew the land, while a profitable hay crop will be gotten the first year. It is safe to say, that on dry lands which you cannot irrigate, wherever you can raise good crops of oats you can raise alfalfa. But I am speaking of alfalfa for the largest profit, and that is on irrigated land.

The ground best adapted is bench lands, not sub-irrigated. You can try alfalfa on lands near a stream where the water table is near the surface and it will do for three or four years and then die out. The plant root will reach to three feet in about five months in the first Summer's growth. It has been demonstrated that the plant will reach to at least three feet, and during the first full season the rootlets will go down about five feet. For the next season the root will go to a depth of eight feet where the water table is low enough.

The Preparation of the Ground.—The Ground should be prepared very carefully. It is much better if you summer-fallowed the field the year before. Sometimes it is preferable to plow

after clover and prepare very thoroughly for next Spring, plowing, harrowing and disking it until you have a very fine seed-bed. It is a small plant, and little clods interfere with it very much, so you cannot prepare the ground too thoroughly. It should be so even that the water will flow over it without washing, thus making it easy for irrigation.

The Time to Sow.—There is not much advantage in sowing too soon. Many have sown as early as April in some portions of this State, but we sow near the first of June, when we know there will not be frost, and sow it alone, not with a nurse crop. The reasons are chiefly these: The alfalfa plant needs the first year the same moisture that goes with the nurse crop, and it is not best to have to irrigate after you have sown, but the ground should be thoroughly moist for seeding; if you cannot catch the seeding time just after a rain, irrigate the ground first, and then sow it after the irrigation. Sow it with a drill and cover it at least two inches deep, not much deeper; by covering it too deep, a great deal of alfalfa seed is wasted. Some sow it as we do clover in front of the disk or through the hose, letting it be covered as we cover our clover; but alfalfa is too valuable to waste the seed. The amount to sow per acre is about 20 pounds, although, if you are sure of getting good seed and the ground is in good condition, 15 pounds will do as well, because the plant stools so that there is not much danger of getting a poor crop.

The Watering of Alfalfa.—We don't water our first crop in the Gallatin Valley. There are some seasons it might be profitable to do so; after a winter such as we have now we will probably irrigate because our ground was dry when it froze up this winter, and where that is the case there ought to be water put on in the Spring, but we may get enough snow and rain early in the Spring so that we will not irrigate the first crop. I never irrigate the first crop, but as soon as we stack we flood the ground, and as soon as we stack the second crop we flood the ground again, so thus far every three crops we have two irrigations.

The Cutting Back of the First Crop.—There is another reason why a nurse crop could not be sowed with alfalfa. Alfalfa ought to be cut back when it gets five or six inches high by running the mower over it. This kills the young weeds and causes

the alfalfa to stool. It seems to enjoy being cut back. If you sow it with a nurse crop, you will notice a spindling crop of three, four or five inches high. Even if you irrigate it doesn't do well; but if you sow the alfalfa alone and cut back, two or three stalks will come where there was one before. I tested this thoroughly this last Summer. A year ago this winter I suggested to the superintendent of the Yellowstone Park, Major Pitcher, when he was complaining that the Government would not give money enough to buy feed for the animals that came down and would like to be fed,—the antelope and bear and mountain sheep, I suggested that he put the field or bottom near Gardiner, just near the line, in alfalfa, since they had taken out a ditch from the Gardiner River. The result was he went to work, prepared the ground and sowed fifty acres of alfalfa. When the alfalfa was high enough to cut back, Major Chittenden came to see me, that his help objected to the cutting of it, said it would ruin it. But on my advice they got the mowers and went to work on it and had the mowers going all the rest of the season, and when we came away in the Fall, about the middle of September or later, they could have mowed a very good crop, it was an elegant stand, and they were very much pleased with the result of this cutting back. It had been something of a theory with me before, although we had been practising it somewhat.

When to Cut.—Alfalfa should be cut before it is stemmy, and the best rule is, to cut it before the blossom appears, but when you see the flower in the bud ready to appear. I was last week in Salt Lake City, which is a great alfalfa country, and noticed that most of the alfalfa hauled into the city had been cut too late; it was stiff and stemmy. We have no alfalfa like that; our alfalfa all bends down like clover does, and then it is a much better crop for the stock, it is not apt to get stemmy, and is much better to handle because you don't lose any of the leaves.

How to Cure, Our Method is as Follows.—My men go to cutting as soon as the blossoms appears. If you waited a week you would get more hay, but you get that in the next crop if you cut it earlier. So we cut very early. We use for clover what we call the buck rakes, where the men ride and go into the field and gather the hay and put it on the stack, so that nobody handles any fork excepting the men on the stack. Two years ago my men stacked alfalfa the same way, but we

had some trouble with it spoiling in the stack, and some trouble with the leaves coming off, because they would have to wait until it was pretty dry in the wind-row. I therefore sent and got the old-fashioned wooden rakes, and I now have them on all my farms. One man walks behind the rakes to lift the handles. I sent east and got those rakes, they cost me \$2.99 apiece there, and when they were delivered in Bozeman I think they cost me about \$6 apiece, and I wouldn't have taken \$12 apiece for them if I couldn't replace them. We follow the mower with these rakes. We rake the hay the same day it is cut. You can't do that with iron-tooth rakes, but these rakes will do it. They follow the mower, and from that wind-row we put the hay in small cocks, such size as a man can just about lift on a fork, and let the curing all be done in the cock. It should stand five days if the weather is dry, and longer if there is any rain, to get it into the stack in nice shape. I presume I had handled altogether perhaps three hundred tons of alfalfa last year; it was all put up this way, and was all in excellent shape. We have been feeding it, and it comes out bright and soft. Now my first crop looks like the second crop used to.

And How to Feed.—We feed the first crop to horses. We save alfalfa for work in the Spring on the farm. We prefer it to anything else, and the first crop of alfalfa is fed to the work stock, and the second crop to the cattle generally, and the third crop we save for hogs and calves and chickens. We are getting lots of eggs in the winter-time, because we feed this third crop of alfalfa to the chickens. We keep it before them all the time, the same as we do before the hogs. We have a little stack in the hog-yard so that they can go to it and help themselves at any time, and stock hogs will do well on swill and alfalfa and keep in good condition.

As to Pasturing.—We used to be afraid of pasturing, but found there was very little danger. Mr. Story, who has a lot of alfalfa near the city, turned in a hundred head of horses on the third crop of alfalfa when it was just ready to cut; he turned those stock all in at once and he told me the other day he did not lose a head. A year before he turned them in a little earlier, while growing, and he lost a few head; but if you turn them through a clover field, which is not so rank, where they can fill up on clover and timothy or something of that kind, and then into alfalfa,

there is not much, if any danger. For myself, I have pastured alfalfa a great many years, and I cannot remember that I lost a head of stock on the alfalfa.

Disking It.—We find that disking thin fields renews the growth. There is no use trying to re-seed an alfalfa field when it gets thin. If you do, the young alfalfa will come up, but the old soon spreads out and shades it so that the young plant dies out, so that it is practically useless to try to re-seed. I disked one field this last Spring both ways, cut it all to pieces; you wouldn't think there would have been anything left from the looks of the field, but it more than doubled the crop.

As to Thinning.—The only thing that thins our crop is letting the field get wet in the Fall and freezing up. That is the only way I know fields are thinned out.

There are fields in Southern California and in the Republic of Mexico that are a hundred years old. A man in Great Falls told me his people in the old country had a field of alfalfa that was over ninety years old. He said it was sowed the year of the Battle of Waterloo, and that field is good yet. Now, in our country, where the water will overflow and freeze, we cannot count upon its lasting so long but I have a field that is eighteen years old that I am going to plow up next Spring, not because it won't pay, but because it has got so thin that we can make it pay better by raising grain on it a year then re-seeding it. The only thing that will thin alfalfa, in this country is letting it get wet and freezing up.

Now, As to the Bacteria and Nodules.—We have no trouble in getting a vigorous growth in the Gallatin Valley. We don't know of any field that needs inoculation; at least, I don't; I haven't heard anybody speak of it; and in the lower country, where Mr. O'Donnell raises so much alfalfa, all the people in that country say that if these bacteria nodules are required, they are there, because it does very well in any place where the ground is not wet or alkaline.

Mr. Daniel E. Bandmann: What drill do you use when you sow alfalfa?

Mr. W. W. Wylie: I don't think it makes any difference, Mr. Bandmann, with this exception, that it should be a drill that can be shut off so closely that it will not sow more than twenty pounds per acre.

Mr. Daniel E. Bandmann: I used a new drill, grain drill, and I sowed about forty pounds to the acre; it was an expensive arrangement. Does that do the growth of alfalfa any harm, putting it too thick?

Mr. W. W. Wylie: Yes, it doesn't do so well if it is so thick. Besides it is a waste of seed.

Mr. Daniel E. Bandmann: Is it your advice to disk it this Spring?

Mr. W. W. Wylie: No, not if it is thick enough.

Mr. Daniel E. Bandmann: It is too thick.

Mr. W. W. Wylie: Well, that will make it thicker yet. I wouldn't disk it. I would say a great many drills are made purposely for sowing alfalfa, an arrangement of cups set in the box, and arranged for twenty pounds per acre, and there is no danger of too heavy seeding, and the results show the seeding was good.

Mr. Daniel E. Bandmann: I want to ask another question, because I am very much interested in alfalfa, and I do think my neighbors do fail, or if they don't they ought to fail. Unfortunately, I don't think we can raise alfalfa as well any way as you do in the eastern portion of the country. As far as you say about sowing alfalfa on dry land, I don't think it is possible for us to do it; if we have no water I don't think we would be successful. My alfalfa I thought was all dead, and I followed the instructions Brother O'Donnel gave us last winter in Great Falls, and I read the same advice and I also read a great deal of the advice that Brother Sutherlin gave—very excellent advice it was—and I followed strictly the advice that you laid down and it came up beautifully green and then it turned into a sort of yellow, and thought I had lost my alfalfa. I put in ten acres. Then I cut it according to the instructions when it was about six or eight inches; it was difficult to cut, but it was too long and I didn't want to risk it any longer, so I cut. Then it turned a little black, and then towards the Fall of the year to my astonishment it came out greenish. Do you think that is going to be a success?

Mr. W. W. Wylie: Yes, sir; that will be all right next summer.

Chairman W. B. Harlan: I would like to ask, Mr. Wylie, what you have found after another year in regard to that parasite Dodder?

Mr. W. W. Wylie: I am very glad you spoke of that. I told you last year that I had found Dodder in my field; it was over in Madison County, and I was about to plow it up, and some person at the Great Falls meeting told me to let it alone and the winter weather and the irrigation would kill it out. My foreman told me this Fall there wasn't a bit in the field. I examined the stacks, and found none.

Chairman W. B. Harlan: That is what I told you.

Mr. W. W. Wylie: The chairman told me he thought it would kill out also. Mind you, the year before we had to have men go and tear the windrow apart before the mower could go along; they went along with forks, and some with their hands through these patches. But this year it was entirely killed out; so I don't think, with irrigated land, you need be afraid of dodder. You can very easily tell the dodder seed with a glass. Alfalfa is a bright yellow, and dodder is darker; the alfalfa is the shape of a kidney, and the dodder nearly round. It is a parasite that gets on the plant. The cattle don't like the dodder, and consequently it spoils your hay as well as spoiling your yield.

Mr. Daniel E. Bandmann: I want to ask another question, but I don't want to delay this meeting. Alfalfa is extending from one ocean to the other all over the United States of America. I am very glad Brother Sutherlin is taking such an interest in it. The ordinary idea is that alfalfa could only grow in light soil, isn't it? That is the ordinary view. I have read in the Rural New Yorker that a man near Syracuse planted his alfalfa in heavy soggy ground, and he said he had between three and four tons to the acre.

Mr. W. W. Wylie: That wasn't sub-irrigated ground of course. It is the only crop I know of that will grow on alkali spots if they are not too strong; it does that with us.

I would like to commend to you, any of you, this little book by Mr. Coburn. I just brought it in my pocket to show you. It is the best treatise on the subject I know of, and deals with all those subjects. This book you can get for fifty cents. To any of you interested in alfalfa it is worth ten dollars at least. It gives you a great many people's experiences.

Q. Have you had any experience in regard to white or sweet clover?

Chairman W. B. Harlan: Which as a weed interferes with the

crop? We have a sweet clover. A number of years ago I sowed a package which came from the seed bureau of Washington. I don't suppose they knew what it was, how detrimental it would be when it got started; and we have been trying to kill it out ever since; it grows along the ditches, about eight feet high, and has a nice odor, but no stock will eat it. That is sweet clover, it is worse than fox-tail with us. It can be killed out by cultivation, but it keeps along the ditches.

Mr. Daniel E. Bandmann: I want to ask you, does alfalfa kill out every weed? I am told it will not kill out wild oats.

Mr. W. W. Wylie: Yes, sir, it will kill out wild oats. Weeds will come in thin patches of alfalfa. The weed that causes the most trouble is dandelion, and the field I am going to plow up is affected by the dandelion. After the first crop the dandelion doesn't kill.

Mr. C. H. Campbell: We had the same experience you had with dodder. Three years ago we had quite a lot of it, so much so that we undertook to dig it off and burn it, and finally it gave us so much trouble that we gave it up entirely. And since that we haven't had it.

Mr. Bandmann asks if I have any success with dry farming. I will say that I have two hundred acres of alfalfa, and can't irrigate a foot of it. The oldest has been in since 1895, and since 1897 has been giving good crops. We always get one good crop, a very fair second crop, and a third light crop. One year we got 32 big loads off seven acres during the season.

Mr. Daniel E. Bandmann: No irrigation?

Mr. C. H. Campbell: No irrigation at all. It is in the Sand Coulee bottom, deep sandy loam alluvial deposit and no seepage.

Another thing too. Mr. Wylie was speaking about the method of stacking. When in St. Louis I noticed that nearly all the machinery exhibits had the old self-rake reapers; I asked them what they were making them for; they said it was to cut alfalfa with. I think it is a good idea, and am going to try it myself. We found the same trouble you have in raking the land. It is impossible to rake it while it is green; we let it cure in bunches or in cocks and then load it on the wagon. But we have practised the unloading of the whole load from the wagon at one time, a good team will pull from twenty to thirty hundred on to the stack in from three to five minutes; no pitching at all, except perhaps two or three forkfuls at the bottom. It is a very simple

matter, and we tried it after trying the cable and forks and slings and various other stacking arrangements. We have a half basket rack 9x18 feet, on which we use a heavy rope sling, consisting of three through ropes and about four cross ropes. This sling is placed on the floor of the rack, with the end loops hitched to the four corners of the rack, so that they will not be covered by the hay; there is also a loop in the middle of the rack on each side that hangs down low enough to be free from covering by hay. The hay is thrown on to the wagon, on top of the sling, in loads of from 2,000 to 3,000 pounds, according to the strength of the team. The load is driven up with the side of rack snug against the end of the stack, and the team that unloads draws by a rope long enough to extend 20 or 30 feet beyond the opposite end of the stack; that is, the trolley rope runs over the center and length of the stack and has three prongs that are attached to the three loops on the sling on the opposite side of the wagon from the stack. To the loops of the sling on the side of the rack, next to the stack, we attach a rope about thirty feet long, the length of these ropes, of course, depending on the size of the stack to be made. The man who does the stacking takes these three ropes and pulls them up tight and holds them by means of a fork stuck in the hay on top of the stack, around which the ropes are twisted. Then everything is ready for the team to pull on the trolley rope, and the hay leaves the rack, the side stakes having been previously taken out, and rolls up the stack on the three ropes that are held tight by the man on the stack. The team pulls straight out from the opposite end of the stack from the wagon. In order to do successful stacking with this rig, it is necessary to make the bottom of the stack at least eight feet wider than the length of the wagon, as if this is not done the hay tends to roll off the sides of the stack; and it is also necessary to keep the end of the stack next to the wagon on an incline. It takes at least 25 tons to make a stack with this rig, and it is just as easy to stack 100 tons in the one stack as 25 tons. In order to top the stack in good shape, after we finish putting on, we pitch from the sides to the center.

A Member: It takes several men to tear those rolls apart?

Mr. C. H. Campbell: No, one man can do the stacking. One goes against the other; the team is pulling one way. But the end of the stack next the wagon of course is a gradual incline. If you want to top it square, you have to pitch it on. It is the best and cheapest of anything I have ever seen for handling hay.

CROP ROTATION.

By Prof. A. Atkinson, Agr. College, Bozeman.

A rotation of crops implies not only change but change in regular order; that is, that different crops shall be grown in something like regular order through a longer or shorter series of years, finally getting back to the starting point. This subject has engaged the attention of investigators and farmers for a great length of time in all the older parts of the world where agriculture has reached its highest development.

That some definite system of crop rotation must be adopted if farmers hope to get the best returns from their farms is a proposition that admits of no denial. At the present time the agriculture of the South is suffering a serious set back as a result of growing a single crop year after year. On many southern farms cotton after cotton was grown until the crop returns were not sufficient to cover the expense of planting and harvesting. The ravages of the boll weevil have been regarded as a calamity by the southern planters but the indications are, that the seeming calamity will be the means of bringing unthought of prosperity to those on whom it has fallen. Out of sheer necessity a variety of crops will be grown, and the advantages of such variety, gained.

The converting of the soil's elements into marketable commodities is the business of the farmer and the system which permits of highest returns with the greatest economy of these elements is the one to be adopted.

When a single grain crop is grown continuously the supply of the soil's plant food is drawn upon and no provision made to compensate for the loss. It is the same as checking against a bank account and never depositing anything by way of keeping up the account. In either case the demand will meet with but feeble response. But some may say, "add plant food by returning manure to the land." While in part this may be a remedy it is only in part, for the single crop grown makes abnormal demands on certain food elements and these are contained in the manure applied in only normal amounts. By varying the kind of crop grown, the demand for food is not always in the same proportion on the different elements. Different crops require varying amounts of food elements, as is the case in a single crop

system, a rotation of crops distributes the demand thus permitting of much greater total returns.

Again, if a single crop is grown continuously the weeds that thrive best in that crop multiply rapidly and get a firm foothold on the farm. This will greatly reduce the returns and seriously interfere with farm practices later. The same may be said of injurious insects. If plants of a single variety are grown continuously on the same land its insect enemies are likely to multiply rapidly, since they are furnished with a full and continuous supply of the food on which they thrive best, while if a wise rotation is practiced they may be starved out in many cases. Fields kept long in grass are likely to become infested with wire worms. If a rotation is practiced few of these are likely to be present.

Of the above objections to a single crop system the one requiring greatest emphasis is the depleting of the food supply and the ruined physical condition of the soil that usually accompanies such depletion. Investigations show that the plant food element having the greatest effect on crop yield in Montana is Nitrogen. This is because the supply of this element is not as great proportionately as the other important elements.

Though 79 per cent of the atmosphere is nitrogen the cereal crops are not benefited because of its presence in this form. Only the leguminous crops, amongst which are the clovers, including alfalfa, and peas, have the power of appropriating atmospheric nitrogen and incorporating it with the soil for use by succeeding crops. Experiments show that after producing any of these leguminous crops the soil is much richer in nitrogen than before such crop was sown. This is of inestimable value to the farmer, affording an inexpensive way of keeping up the supply of this most important element.

In addition to their value as nitrogen gatherers clovers have a high value as soil renovators. The remark that the soil gets "harder to work the longer it is under cultivation" is a common one. The reason usually offered is that "the seasons must be changing." While the settlement of a state is an occasion of importance in the life of a nation, evidence showing it to have a very marked effect on the great nature forces is somewhat scant. The growing difficulty is accounted for by the fact that the soil has been robbed of the humus content accumulated during

the centuries previous to man's interference. In the presence of a large amount of decayed vegetable matter the soil warms quickly, holds a large quantity of moisture, and admits air freely. Under the one crop system all too frequently practised in newly settled districts this constant robbing process deprives the soil of this valuable humus and leaves it hard to work, and uncongenial for plant growth. By its numerous penetrating roots which decay in the soil, the clover plant does much toward restoring the soil in that desirable condition in which man received it at nature's hand.

Local conditions decide in a large measure just what rotation shall be adopted. It is well to introduce a leguminous crop such as clover or peas at least twice in every five or six years. In sections where one particular crop is of especial value it ought to be grown as often as good soil management will permit. The more feeble growing crops such as barley, ought to follow closely after the nitrogen gathering crop. Two cereal crops may be grown in some cases with profit. The main point to have in mind is that long experience particularly in the older agricultural sections indicates the absolute necessity of some definite rotation if, the best returns are to be secured. America's lasting prosperity is based on America's agriculture and America's agriculture will stand or fall accordingly as the soil's fertility is utilized or wasted.

ORIGINATING AND TESTING VARIETIES.

By F. B. Linfield, Agri. College, Bozeman.

What is a variety? It is a plant or animal different from its fellows. What? Then everything, every object in nature, is a variety as no two things in the world are exactly alike.

This unlikeness of things our old teachers would tell us is due to the influence of changed environment; climate, food, care, training, etc., apparently assuming that the natural condition is a fixedness of organism.

Prof. Bailey of Cornell changes this point of view and claims that unlikeness is the natural order of things and that fixedness of character is acquired, so that a change of environment permits the natural tendency to variation to have more or less free play.

Prof. Bailey says that fixedness or rigidity of organism soon means death. When an organism or race ceases to vary it starts to die; so in the past we find that groups and races of plants and animals have disappeared. They could not adapt themselves to the changing environment so they died. I was reading a few days ago that it is so with ourselves. As age creeps on us our bodies become rigid—fixed; the joints are stiff, the muscles inelastic, we ossify and are dead of old age.

But it is evident that those slight variations which we note everywhere in nature are but the beginning of what we consider variations agriculturally or horticulturally speaking. An agricultural variety should have some distinct distinguishing qualities which could be readily recognized.

These differences which make varieties may find expression in three ways. 1st, in marked and easily recognized differences in external appearance or in habit of growth. 2d, in changes in internal structure or internal quality. 3d, in differences in the life germ which, however, cannot be recognized by any physical means.

The first class of varieties are illustrated by the different breeds of live stock, by many of our different fruits, and by many of the different grains. It is not difficult to tell a Short-horn cow from a Hereford or Polled Angus, or a Cotswold from a Shropshire sheep, or a Duchess from a Wealthy apple. These all differ in color and in build or shape.

The second class of differences may be additional factors in making the varieties just noted but in others it is not possible to

find much difference in the external appearance of the variety, but when we examine the make-up of the varieties we find that they differ in composition and quality. Two apples may look almost like and yet when cut and tasted they may be altogether different. This may also be true of other kinds of fruit. Grains of corn may look exactly alike yet one lot may contain more oil, another more protein and another more starch.

Again in the third place some plants in their habit of growth in their external and internal appearance may be practically alike; they could not be picked out as separate varieties even by the greatest expert, yet one gives a much larger yield than the other; it produces larger crops. It is hardier and thrives better under adverse conditions.

Our next question is: what causes or induces agricultural varieties? This is not due to one but there are many causes. Climate is a very large factor in causing variations. The corn plant in the South grows 10 to 12 feet high and takes 6 months or longer to mature. In Montana it is a comparatively low plant, quite leafy, and matures in 3 or 4 months. In the South the ears have a long thin hull and weigh but from 30 to 32 pounds to the bushel. In the North it is short and plump and weighs 40 pounds and over to the bushel. Many Eastern varieties of apples when grown in Montana are scarcely recognizable by the eastern fruit growers. The change in locality has varied the appearance and character of the fruit.

The food supply also tends to produce variation. The lack of food coupled with other hard conditions dwarfs, as we see in the Shetland pony. A plentiful supply of food tends to promote rapid growth and growth to a larger size.

Shelter or protection, or the absence of it, also may cause variation. This is, however, a question of climate. Shelter is the creation of an artificial climate. Protection from competition with plants gives more room, more light, more food; thus the tendency to variation. To the higher forms of life, training has an influence in increasing or developing natural qualities. By training, a horse may be made to go faster; a cow to milk longer and to give a larger quantity of milk.

Sex, or the mixing of two organisms to produce a third, seems to be nature's method of encouraging variations as well as to give greater vitality. Man recognizing this has used it to break

up a fixed type and to give marked variation by mating it with another of greater or less difference. This crossing or hybridizing is used to a considerable extent in originating new varieties. If the cross is too radical sterility results, which is the end of the race—the mule is an illustration. With some plants crossing so disorganizes them or so thoroughly breaks up the type that it is practically impossible afterwards to fix the variation. Bailey gives an instance where the seeds from one squash, the product of a cross gave 110 distinct types that could be readily recognized and named, and not one of these was like the parent. The crossing of distinct types to get new and improved varieties is a game of chance where the chances for an improved variety are generally only one in thousands and sometimes one in millions. Such methods are very expensive but sometimes the results are well worth the cost.

It is evident then that any change in conditions or surroundings may induce change in animals or plants. Generally but few of the causes mentioned above may be active and the changes are gradual and much time is necessary before marked variations result. Sometimes, however, perhaps from an accumulation of untraced or unrecognized causes, a markedly new type may be produced. In plants we frequently notice this as a bud variation, or sport. Crossing may give us the same result in both animal and plant.

Our next question then is how are we going to fix or save our varieties. Occasionally it has been noticed that a new type, that through crossing, or as a sport comes suddenly into being, has all the attributes of a stable type and reproduces itself exactly. This is the rare exception, however, and so we must work to fix the type.

Here two methods are used; the sexual and the asexual. The latter is used almost altogether with fruits and with many greenhouse plants which are propagated from cuttings. Apple seeds, perhaps from a direct cross of varieties, or perhaps from a mixed lot of seeds from many sources are sown. Twigs from desirable looking shoots are grafted onto a mature tree and soon fruited. If it proves a desirable apple, branches of the tree are taken and grafted onto other trees, so that all succeeding trees of this variety may be considering to be but branches of the original tree:—the living variety is divided up. With these seedling

apples as with Prof. Bailey's squash, probably every seedling is a variety. The question is how to find the desirable variety and to find it quickly.

Varieties which are the result of a cross, particularly of a radical cross are generally difficult to fix by the sexual method and it frequently requires several years of careful selection and the constant weeding out of undesirable forms to get the seed to produce true to type. With animals and certain plants in-and-in breeding is resorted to, accompanied by rigorous selection. This practice tends to concentrate and unify the type and where practical soon fixes the variety. Carried too far, however, it may lead to weakness and infertility, and this danger must be guarded against.

Probably the surest and quickest method of establishing new plants and animals or even of making markedly new types is by what is known as selection. With a definite and well thought-out ideal of what is wanted in mind we select from a large number of plants those varieties which come nearest to our ideal. The seed from these are saved and planted and again selection is made of those most like the ideal. By this method, of rigorous selection from among a very large number of individuals and along a definite line, we in a very few years get a well marked variety which is fairly stable in character.

Nearly all of our varieties of grain and vegetables have been produced in this way. By selecting and growing only the variations man in a few years accomplishes what it might take nature hundreds of years to do. Under nature variations are soon swamped by the number of normal kinds unless the variation possessed some marked advantage, when in time it may, through its greater productiveness and verility, dominate and give character to the type. Man isolates and encourages these variations and so brings them quickly to the front.

The mere fact that any plant or animal is a variety may be an interesting fact but it may have no practical value. A variety is valuable when it possesses some qualities that make it more valuable to man than any variety at present cultivated. This extra value may be due to its superior quality or to a wider or special adaptability or because it is a larger yielder. To find whether the new variety comes up to any of these requirements it should have to be tested in other words, by examination or

experiment we must determine the facts of its superiority. Whether a new variety of fruit is of good size and quality is determined by growing it to maturity and then critically examining it. Is the tree hardy; a good bearer, etc., can only be determined by the test of time and the seasons.

Of a new variety of wheat we have to determine its hardness and its milling qualities and finally is it a large yielder. The milling qualities may be determined by a milling test, but the hardness and yielding qualities are determined only by growing it for several years and noting carefully the results.

We might thus go through the list of farm crops for each of which some special thing should be noted but the above will serve for illustration.

Even with varieties that are propagated by cuttings and especially those propagated by seeds, there may be a strong tendency to vary so that all varieties should be grown for several years before being introduced. Careful observation and selection by an expert continued over several years will give greater stability and value to the variety.

In such a state as Montana, great in its area, great in its variations of climate and soil, with mountains and valleys, with farming districts ranging from 2,000 to 5,000 feet above sea level; with a rich soil and abundant sunlight, with our extremes of heat, cold, and dryness in many places, and with our peculiar agriculture, there is very great need for the originating of new varieties better adapted to our peculiar conditions.

The fruits early grown in the U. S. came from Europe, but those early varieties have largely disappeared and we are growing their descendants of the 1st, 2d, 3d and 4th, generation that have made themselves at home amid the new surroundings. We of the far west have drawn our supply from the east and find but few that will do well. I believe the lessons of the east we will have to repeat—we must create our own varieties. He who will take hold of this problem and unremittingly pursue it will hasten the coming of those new and better types and will reap his reward in the satisfaction of a duty well done and in the blessings of future generations.

WASTE PRODUCTS OF FARM AND HOW TO USE THEM

By Hon. Fred. Whiteside, of Kalispell.

Every product of the farm is the result of labor, and whenever we fail to produce an article with the least possible labor we are to a greater or less extent wasting our substance, for the basis of all substance is labor. So my remarks upon this subject will relate to labor and the methods of doing work quite as much as to the articles produced. We hear a good deal about diversified farming and the advantages of raising many different varieties of crops, but I want to say to you that there is quite as much danger in diversity as there is in the lack of it. One extreme is just as bad as the other and the farmer is to be congratulated who attains the happy medium where he has sufficient variety to obtain the best value. He who has so many crops and different kinds of stock that he cannot properly attend to any of them is just as badly off as the man who robs himself and his land by growing only one variety of crop. Concentration of effort is necessary to success in any line of work, and whenever you scatter your energy over too broad a field your harvest is sure to be light.

In my judgment one of the greatest sources of waste to the farmer is the almost universal effort to cultivate more land than he can properly care for. We are all more or less grasping and it is only natural for the farmer to suppose that his profits will be measured by the number of acres he is able to till, but a greater mistake never was made, for we often see a man struggling along with a large farm, he is in debt and has a hard time to make both ends meet, while just across the way a farmer with one-fourth the number of acres is making a comfortable living and is saving something for a rainy day. Of course the difference may be entirely in the men themselves, but it illustrates the fact that the profits of the farm are not regulated to any great extent by the size of the farm.

In newly settled sections where land is cheap and easily secured the farms are generally large, but as the country settles up and land values increase the farms are divided and subdivided, but the profits of each man are increased rather than diminished. This of course, is not all due to better methods of cultivation but partly to better markets and improved methods of transportation that come with the natural development of the country.

Contrary to general belief, it costs the farmer just as much to place a meal upon his table as it does the resident of the city. The mere fact that the farmer's labor is not first put in the form of dollars and cents does not make the cost to him any less, for the real measure of value is labor, and by this standard the farmer usually pays more for what he has than does the resident of the city. Everything that is consumed upon the farm is worth just what it will bring in the market, and, if more is consumed than is necessary the difference must be counted as wasted, and every dollar wasted means a dollar less in profits. In this matter I have reference more particularly to the feeding of stock, and in this direction I believe many of our farmers are inclined to be careless. Every pound of hay and grain upon the farm has a cash value, and if the farmer can not get more than this value by feeding it, then he is feeding at a loss. This applies to the feeding of horses as well as to stock intended for market. Horses must be fed the entire year whether we have work for them or not, and for this reason the horses are a great drain upon the farmer's pocketbook, especially where he keeps a few surplus head as he often does. At ordinary prices of feed it costs about \$150 per year to keep a team of horses upon the farm and in my own experience I have found it cheaper to hire a few extra teams during the busy season in preference to owning a large number of horses and keeping them the year around. Of course we could not all do this for there would not be enough teams go around, but many of us would dispense with some of our horses and still get on quite as well with our work.

Do not imagine, however, from my remarks about the saving of feed that I am in favor of short rations for stock; quite the contrary. I do not believe in the system of keeping a large herd that look very well in the fall but must be half starved during the winter and come out like walking skeletons in the spring. This system I believe is wasteful in the extreme, for you not only lose the flesh that must be replaced at the cost of more feed but the animals themselves never fully recover from such a period of starvation. They must all be stunted in their development, some of them more than others.

My theory is that every animal should be well fed from the time it is born until it goes to market. Such animals bring far better prices and the same weight can be reached in much shorter

time, the well fed 2-year-old steer often weighing more than the 3-year-old, that has been starved and stunted. So the man who has only sufficient feed for fifty head of stock should not endeavor to keep a hundred for he is wasting his substance by doing so.

Another very common source of waste is the method of caring for stock. An animal that is kept in a clean comfortable place will thrive on less feed than one that is obliged to face the blizzards or stand in a cold filthy stable.

Another method that is often a source of waste is our method of pasturing stock. We usually turn the stock on the grass in the spring and give them the run of the pasture the entire season. A better method is to divide the pasture into several different lots so as to allow one portion to rest and grow while the other portion is in use. Moderate pasturage stimulates the growth of grass while close pasturing injures the plant and prevents its growth. A proper division of your pasture will increase its value by fifteen or twenty per cent and a dollar saved is equal to a dollar earned.

Another matter to which more attention might well be paid is the improvement of seed. It has been said and quite truly, I believe, that \$10 an acre has been added to the value of all corn land in the Mississippi valley by improved seed corn. Scientific improvement of seed has increased the yield of corn by fifteen or twenty bushels per acre and the same results can be attained in other products. Keep in touch with the experiment station of your state and with the department of agriculture at Washington. Seeds of new varieties of grains and grasses may be secured from these sources and very often a variety that is not very promising in some other section may prove to be valuable in your section. Above all keep everlastingly at it; plant a few new varieties every year, and although only one variety in fifty proves to be of value you will be repaid a hundred fold for your trouble. There are many wild plants and grasses that are worthy of cultivation and every farmer should be on the lookout for such plants. A neighbor of mine has been cultivating a wild fibre plant which he found growing in the fence corners and which appeared to be a coarse looking weed. It grows six or eight feet high and the stalk is composed of a fibre that is stronger than flax and is whiter and finer than cotton. It is worth \$140 per ton, and an acre will produce several tons of it.

It requires somewhat different machinery from that used in working other fibres and as soon as this detail can be worked out he will have an unlimited market for all that he can produce.

One of the hardest problems for the farmer to solve is the proper rotation of crops especially in this northern country where the variety that can be grown is not as large as in sections having longer growing seasons. The object in changing the kind of crop grown upon a piece of land is of course to retain the fertility of the soil while increasing the yield, and the crop that will best accomplish this dual purpose is the best crop to grow. Clover and field peas have been mentioned as good crops for increasing soil fertility, but clover is not a good single season crop while there is usually no market for peas. They make excellent food for stock but it is not always convenient to feed the entire crop. The best crop, in my judgment, to restore soil fertility and, at the same time yield a profit, is the potato. When you talk to the ordinary farmer about planting 40 acres of potatoes he is appalled at the amount of labor involved, but the labor required is not as great as an inexperienced person might expect. If your land is free of fixed stone you can use the two-horse planter and the four-horse digger and thus save a good deal of work. I have been planting over 40 acres of potatoes each season for several years past, and as my land contains some large stone, I have not been able to use any machinery except the plow, the cultivator and the harrow. In planting potatoes I plow them in quite deep, dropping the seed about 20 inches apart in every third furrow. Three men with two teams can plant about four acres per day or forty acres in ten days. In harvesting I plow them out and it takes twelve men and two teams about 15 days to harvest 40 acres. One team does the plowing and the other hauls the potatoes to the cellar. One crop of potatoes will increase the yield of your land in grain by fifty per cent and sometimes as much as 100 per cent. Plowing the potatoes out in the fall leaves the land in excellent condition for spring sowing.

In cultivating potatoes, I use the harrow almost entirely going over the ground many times even after the vines are quite large, but after the vines are good size I use a light harrow called a weeder, which in appearance looks like a hayrake without any wheels.

It is the small things upon the farm that go to make up the

profits, and a failure to save the little things generally means that the farm is run at a loss instead of a profit, and in this saving of the little things the farmer's wife is generally the chief agent, so in the last analysis the farmer is dependent upon his wife and for this reason he should give her every help and facility for doing her work. The average farmer pays too little attention to the convenience of the household. Water is the greatest agency in the doing of housework, and yet it is often the scarcest article in the household. An abundance of water in the kitchen is a luxury not difficult or expensive to secure. If you haven't a spring that can be piped by gravity, a windmill and tank will answer the same purpose, while a few dollars will supply a hot water tank to be connected with the kitchen range.

Another convenience that every farmer can supply by his own labor is a kitchen drain or sewer. Give your wife plenty of hot and cold water and a good drain from the kitchen sink and you will have lightened her labor by half. She will then have more time to look after the little things that make life upon the farm more pleasant and profitable.

The farmer's table would be bare indeed without the pickles and preserves, the jams and jellies and other good things, which the farmer's wife knows so well how to make. The list of these articles that can be preserved for winter use may be extended almost indefinitely. Green peas, string beans, rhubarb, and many other articles can be added to the mid-winter bill of fare. Wine and vinegar of delicious quality can also be made by the housewife and these can be made from the juices of almost any of the wild or tame fruits.

For making wine the juice of the tame cherry or the wild huckleberry is perhaps the best. If you haven't a fruit or cider press the juice can be extracted by first mashing the fruit and then pressing in a clean gunny sack under a weight. After pressing put the pomace into an open barrel or keg and cover with water, let it stand 24 hours and then press again, put the juice from first and second pressing together and after straining add about three pounds of sugar to the gallon, and set in a cool cellar to ferment; after fermentation, which takes several months it should be racked off several times in order to get rid of the sediment that accumulates in the bottom. In making vinegar the same process is used, but any kind of fruit including plums or

pears can be used. For vinegar only one pound of sugar per gallon should be used and keep it in a warm place instead of in a cool cellar. A keg or barrel with a thin cloth fastened over the bung hole to admit air and keep out insects is a very good receptacle to use for ripening the vinegar. Always use the same vessel, for an old keg or barrel will ripen vinegar much faster than a new one.

THE IMPROVEMENT OF OUR FARMING.

By Prof. F. B. Linfield, Bozeman, Montana.

The president told me he was short of material this evening. I told him that I can always talk but do not know whether I can say anything. Then I thought, what should I talk about, and it occurred to me to say a little about the question of science and practice. I was looking around the hall this evening and, looking at those lights; it looked as though that one, with the Welsbach shield was burning no more gas than this and yet it gives a great deal more light. Now, somebody had been thinking about that matter, and he put his thought into practice; he must have been a scientific man because he must have known something about the position of that shield and the effect of light upon it, and so he put science and his knowledge of his science into practice. I remember, as a student, hearing a story told by one of the students of one of the teachers at the college,—a teacher of chemistry, and, by the way, a very interesting and valuable teacher in his work. He was talking at a farmers' meeting upon the subject of soil fertility and the agricultural chemistry phase of agriculture, and after he had got through some old gentleman back in the audience got up and asked him what time he would wean a calf, and the professor collapsed. His science had not got that far.

I was very much interested this afternoon in some of the addresses given to us, and in the addresses of welcome and response, and was thinking about the inspiration that comes from such meetings as this. Some people say attendance at these meetings costs money, and yet, after all, what are we living for? To make money? Money is a very nice thing to have, and still if that is the aim of life it is a very poor aim. The question of

doing the most we possibly can in making the lives of ourselves and our families and of our neighbors enjoyable and profitable is very much more important, and I think we learn a great deal about the possibilities of improving and the possibilities of striving to do better at such meetings as this. They have also a broadening influence. No man can run up against his neighbor in such a meeting without being benefitted. On the farm we are in a measure isolated, and I think from a farmer's standpoint there is nothing that is of greater advantage to him than to at times get away from home and rub up against his neighbor. Again I sometimes think it would be a good plan if we would double up on that coming away from home and take our wives and families along with us, as I think all of the family will be the better for the going.

And then again—and this idea applies particularly to our horticulturists—we are pioneers. The man who plants a tree is considering more than himself; he is considering the future; because from the trees which he has planted he may not live to reap, but he has faith in the country, that succeeding generations are going to reap if he does not. And then there is that other thought in regard to the man who plants a tree; he is more than a camper; he is there to stay; he is a home-builder, and a home-builder is one of the things we want more and more of in Montana. For that reason I think the horticultural people in this State are worthy of unlimited support and encouragement. The making of a home means a great deal to the young men and women who are growing up in this country, and I think upon the farm as ideal a home may be built, and I think in some particulars homes more nearly ideal, than in almost any other place that we might think about.

Again when we consider these fertile irrigated valleys, where 80 acres of land will produce as much as 160 back in the humid east, where we can get together and enjoy upon the farm all of the advantages of the town and village. I look for the time, I expect to live to see it, when we will have in our country districts as good schools as we now have in the towns; when, with the increasing population, the more thorough cultivation of the soil, the larger returns from each acre of land, we are going to have the consolidated rural schools where the children from various districts will come together, and right in the

country districts you are going to have a graded school. And in that way you will enjoy all of the advantages that are supposed to accrue only to the towns and cities. More than that, I think as things develop, and as we learn more and more how to do those things, we are going to have in those rural schools the opportunity for the young men and women to become scientifically and practically acquainted with their work as workers upon the farm and in the garden. I don't know of anything that, if it is correctly understood and correctly presented to them, would be more interesting and more valuable to those young people than communion with nature, even as they are growing up; and I would see around those rural schools, gardens where those little boys and girls can see things grow and study nature at first-hand. That is what I call 'nature study' as I would like to see it in our schools.

I think if there was one thing that impressed me more than anything else in my visit to the World's Fair at St. Louis, it was the biography exhibition which was put in their exhibit by the Cash Register people of Dayton, Ohio, showing how they had with their employees aimed to interest them in the work of the schools and also in the gardens surrounding those schools. It was a humanity side of that strict business proposition. These business men found that the more efficient their men—and the efficiency came from the greater enjoyment, happiness and contentment of those people—that it was a question really of larger returns for themselves.

Now, I want to say just a few words on another point, and that is in regard to our experiment station work. I am only going to refer to this very briefly. I refer to it because, as director of the experiment station, I sometimes think that the people get impatient with us, that we don't accomplish as much in a given time as we should do, that we don't cover as many fields, or as many subjects as we should do in our work. Now, I want to say to you that it is not a question of what we would like to do in any sense, but it is a question of ability solely and only. It is expensive work to carry on experiments, it makes no difference what the line may be. We are delving into nature; we are groping after hidden facts. Often there has been no path hewn out by which we can travel, and so we have, like going through a virgin forest, to hew our way, and often that hewing away

brings nothing but negative results, nothing positive. In fact a great majority of our experiments do not end in showing what will be best to do, but rather showing what will be the things to avoid, what are the things not to do. For instance, we are carrying on, and have been carrying on for two or three years, an experiment in feeding steers. And to illustrate, we are feeding one lot three pounds of grain a day and all the clover they will eat; another lot, clover hay and five pounds of grain per day; we are feeding another lot on all the clover hay they will eat and seven pounds of grain per day; and another lot on all the clover hay they will eat and ten pounds of grain per day. Now, we have carried on that experiment this winter. We may repeat it next winter and the next winter. We are dealing with a living organism. The weather this winter is different from what it may be the next and the following winter may again be different, and so we must average up one year with the other. I was looking over the results the other day, and found that there is not a proportionate difference in the gains those animals have made. We have been doing the same thing in regard to sheep, and we will report next year in regard to this work. I find that ten pounds of grain does not give three times the gain made by those fed three pounds of grain. I find that three to five pounds—I am not sure which—is going to give us the best results, and the others I have discarded as useless; they simply give us negative results, not positive results.

Again, for the past three or four years we have been trying to find out, in co-operation with the United States Department of Agriculture, what loco poisoning is. The United States Government and ourselves, counting the pay of the men and expenses put into that work, have spent probably two or three thousand dollars a year, and perhaps more than that, and we have worked for two or three years and we have not yet found out what loco poisoning is. We have found out some few things, but we have not found what loco poisoning is. We have found that a great many sheep are affected with parasites of one kind and another; that is as far as we have got. We are feeding a bunch of locoed sheep this winter. If I had not been feeding those sheep, I would have had a bunch of wethers and made money out of them. The locoes were nothing but skeletons when they came on the farm, and we cannot make any money out

of them; it is simply a question of spending time and money in gathering facts that may be useful to the people. There may be no return at the final outcome; it may all be loss, but we are working along those lines, and may have to work one, two, three or ten years before we can find out what loco poisoning is.

Another instance, a few years ago in Gallatin Valley, fully half of the land cultivated was summer-fallowed one year and the next year was put into a grain crop. But we have nearly got rid of summer-fallowing in the Gallatin Valley; very few farmers are summer-fallowing now, that is on the watered land. I was talking to our new superintendent of public instruction; he is also a farmer; he has a neighbor who has been summer-fallowing and continuing the practice right along and the farm had practically run down. But the superintendent of instruction had been growing clover followed next year by a crop of grain, and the result of that practice was that after a few years he built up his farm and last year had ninety bushels of oats to the acre. His neighbor had nothing on his soil the year before—he summer-fallowed—he had put his work on it with no return, and in addition to that he only got seventy-five bushels of oats to the acre the following year. Mr. Harmon had a crop of clover worth \$20 per acre instead of the summer-fallow and last year had ninety bushels of oats to the acre.

So I think the results at the experiment station have demonstrated that, if you desire to keep up the fertility of your soil, if you desire to continue to reap large crops of grain from that farm, you have got to grow clover upon your soil. Prof. Harmon says the price of clover has gone down, he can't get as much as he used to,—probably less than five dollars, but I asked him, "Are you going to grow clover next year?" he says, "I can't afford to do otherwise." The experiment on the experiment station farm that were carried on two years ago bear out this proposition, and to-morrow Mr. Atkinson will elaborate this point. I refer to it here merely because it illustrates the point, but he will give you the figures exactly. But on this question of clover, we had a piece of clover in a field and right beside it we had oats, barley and wheat; the next year, where we had the clover we had 100 bushels of grain to the acre, and on the land where we had the wheat, oats and barley, we had about 50 bushels to the acre. It pays therefore to consider those points. Those are dem-

onstrations which we are making; the results on this latter point are greater in this State than in any other district I have visited, because we can grow greater crops in Montana than in any other districts I have visited.

Another point, I wish to refer to is the question of good seed. I think we often make mistakes right there in not getting hold of the best. We go on year after year and take grain out of the bin and sow it, and usually because the deterioration is so slight, we don't notice it, though our grain is getting less and less vitality; there is less of the ability to reproduce largely contained in that seed, because the seed is not the best but the average of the poor varieties of seed.

A student came to me recently and wanted to buy two sacks of oats, and after telling him the price. He said, "I can't pay it; it is too much." However, we were distributing ten pound samples, were giving them away; he took a sample home, and agreed to follow our instructions, and to sow the ten pounds of our seed on one-eighth of an acre. Right beside it, separated by a 2-foot row, he sowed ten pounds of his own seed, sowed at the same time and in the same way. He came to me in the Fall to make a report on the crop. Those oats he got from us we had selected from high yielding varieties; out of several varieties we have selected a few as being the largest yield of oats growing on the farm. And he said those oats obtained from us yielded at the rate of 75 bushels per acre, and right beside them the oats from his own seed yielded only 30 bushels to the acre. Why? Same grounds, same cultivation, same seeding, same man,—but different seed and a great deal of difference in the result.

I was very much interested the past summer in visiting the experiment stations in Iowa, in Nebraska and in Minnesota and talking about the method of improving corn, as followed by the Funk Brothers, who grew large quantities of seed corn. Prof. Holden, who now has charge of the work of farm crops at the Iowa Experiment Station, took hold of their work and in three years raised the average crop of corn on the Funk farm, a very large farm, from forty to forty-five up to over seventy bushels of corn to the acre.

We have, on the experiment station ground, grown for the last three years several varieties of barley; one variety right straight along yielded not more than 40 to 45 bushels of barley to the

acre. In the same field, right beside it, three years in succession we have had another variety of barley, in our small field-plots, which has yielded from 97 to over 100 bushels of barley to the acre. Doesn't that mean that there is a great difference in those seeds.

This is one of the things we are doing, trying to introduce a large number of these varieties that we know will do well under Montana conditions, and if we can increase the crop of oats or barley or wheat in this State by five bushels per acre, it will pay ten times over to this State all of the cost of the experiment station in all the time that it has been in existence. I have figured it out.

Now I think, Mr. President, that I have talked long enough. There are several of these points that I would like to call to your attention, but I must forbear. I just wanted to call your attention to these few things to show you what we are doing, to call your attention to the fact that it is not one or two years, but sometimes three, four and five years before we can promise you results from any line of work. It is slow, this experiment station work, and yet after all it is only by this slow process, by the accumulation of facts little by little, one upon the other, that we can at last attain to the ultimate knowledge. And it is by these experiments that we finally get more complete control, that we finally get to know more and more about these things, because from them we may finally get to know just exactly why one year you only get 40 sacks and why another year you get 150 or 250 sacks of potatoes to the acre. We are working along those lines; we will find out after awhile, but give us time; we don't expect to know all about these things even if we work at them as long as we live; we expect there will be things to be found out years and years after all of us have passed to the great beyond.

Again, in our experiment work, I would like to say this, that we are there to serve you, we are your servants. We want to do to the very best of our ability what will serve the people in this State best, and we would like you to come over there and visit us and look at this work that we are doing; we want your counsel; we want your advice; we want your criticism. Our ambition is to improve just as fast as, and as far as we possibly can.

Chairman W. B. Harlan: I would like to hear some talk and discussion.

Mr. C. H. Dallman: Mr. Chairman; I would like to ask Professor Linfield if the value of a fertilizer would not be still greater increased if the clover were left on the ground or, still better, plowed under? I am interested in fertilizing, and if I can make more by sowing clover I will do it.

Prof. F. B. Linfield: It would depend. There is more fertilizing material in the root than in the top. If your soil is lacking in humus particularly, if it is a light soil, then if it was plowed up in the fall before with a certain amount of clover on top of it, your results would be a little better, but not proportionately as much better as you would expect. If you would take that clover off and feed it to stock and save your manure, taking good care of it as you should do, the manure would contain nearly all of the fertilizing material that was in the original crop, and in addition to that you would have one of the most valuable foods for feeding young and growing cows that you could possibly have on the farm, and I believe from eighty to ninety per cent of the fertilizing material of the crop will be returned in the manure, so that you see there is some advantage in feeding as contrasted to plowing it under.

Mr. R. N. Sutherlin: Mr. Chairman, Ladies and Gentlemen. I admit that I am crank on some things, but I insist that the Station shall play fair, and, while I have no cross-swords with the present management of the station, I had frequently with the former management on this question of summer-fallowing, in which I take pride in being the farmer in Montana—not in the United States of course—who introduced it here from California, and I don't believe they state the question entirely fair. Now, it is a scientific fact that land cropped for 25 years under the fallow system in England has produced as much as land cropped every year for 50 years under the system of cropping continuously. Now, they tell us up in the Gallatin to mix clover seed with our grain in the Spring when we sow it with the drill and by the Fall we will have a crop of clover, and the next year we can plow it up and get a big crop of wheat again. That is the argument. I won't say that it is Mr. Linfield's argument, but that was the argument of the station formerly. Now I insist that you can't get the worth of the seed in any amount of fertility that clover, alfalfa or any other legumes would bring to the soil by that system. The crop that grows after the stubble, any crop

that has a nurse crop is stunted, and it does not commence to grow until the grain crop is taken away, and it only has a few months then in which to grow, and those few months are the driest months of the year when there is less water for irrigation, and there is not sufficient root on these plants, nor sufficient top-foliage to these plants to make it worth what the seed cost if you plow it again in the Spring to produce a 50-bushel crop under the clover system.

There are conditions under which the summer-fallowing is a success, and while there is no stronger advocate of the legumes in Montana than I am, I insist that the fallow has a place in Montana agriculture.

Mr. W. W. Wylie: This is the first that I have ever heard of anybody in the Gallatin Valley thinking of plowing up the clover in the Spring and not let it stand at least one season. Our custom there is to sow clover, as he says, with the grain crop, and to give it the next two years for hay. Clover is a biennial, doing well for two years and it is better the second year than it is the first. We found that it did not pay well to let it go only one year, because we did not get a very full stand, so we cut clover for two years; that makes four crops of clover that we cut; then we crop the ground to grain for two years, wheat or barley one year and oats the next year, and we find that this is just as good as, if not better than, summer-fallowing; we get larger yields of grain than we used to get by summer-fallowing every other year.

I am using both methods; I am still summer-fallowing some, but I find that by using clover two years and sowing grain two years on the land that I get just as good in fact better results. I would say here that our method of feeding clover is to feed it on the new fields off the stubble, so that the cattle in the winter time are eating clover on the ground where we expect to raise the hay the next year.

Mr. R. N. Sutherlin: May I ask, Professor Wylie, if your clover wouldn't succeed better if you sowed it on the clean field in the Spring without any other crop.

Prof. W. W. Wylie: It might succeed better for clover, but we would then be without the use of the land for a year, because we then would not get any clover to cut the first year. The start the clover gets the same year it is growing with the grain, and

not harming the grain in any way, makes it all ready to grow the clover next year; and then we get some pasture from it the first year, but we don't count much upon that; we are counting upon renewing the land.

Mr. R. N. Sutherlin: About what returns do you get the second year with your clover?

Prof. W. W. Wylie: We get about two tons to the acre each cutting. That would make about four tons.

Prof. F. B. Linfield: I think perhaps on dry-land farming, hardly upon the watered land, there are conditions where summer-fallowing is all right. If a man wants to continue to grow grain on his farm and get no other crop, he has got to summer-fallow, if grain-growing is what he wants. But if, in addition to that, he wants to do a certain amount of feeding of cattle, especially steers—and those are good crops to grow for fattening those animals—he can do so much better if the year he had summer-fallowing he had clover instead. And the experience I have been able to gather on our own farm and the men from other stations I have talked with—and I have talked with a great many—is that the clover, when plowed up, will give just as large, and in many cases larger crops—than the fallow will, and you have four tons of hay the year before where you had bare ground with summer-fallow. That four tons of clover is certainly worth something, because our farmers figure that it would cost no more than about a dollar a ton to cut it and put it in the stack. So I think summer-fallowing has its place and is absolutely necessary where a man continues to grow grain.

Chairman W. B. Harlan: In the early farming in the Bitter Root Valley we raised very little clover; we had plenty of wild grass along the river, and then the bunch grass on the bench lands, gave us plenty of hay, and everybody raised grain year after year. After a while the land got so foul with weeds that we couldn't get a paying crop; the wild oats from California got in there and then they began to summer-fallow, and they followed that for a few years and only raised one crop every two years, raised a pretty good crop every other year; but they found it cost them nearly as much to summer-fallow as to raise a crop. Since that they have got to raising clover on the land. They raise clover a couple of years and then grain two or three years, and they get crops every year, paying crops; perhaps the grain

does not yield them as much in any one crop as following the years when they summer-fallowed, but it yields much more than they were getting from one-half the number of crops. And the system is now to alternate with clover. The big Daly farm does that. When the Valley was taken up, and everybody got all the good land that they thought would pay to farm, the land that is now the heart of the Daly ranch was lying idle because it wasn't good enough, and under the system those people employ of alternating between clover and grain they get big crops every year of either clover or grain, and there is no doubt that the land is in better order to-day than it was when it was first plowed.

Prof. M. J. Elrod: I would like to ask Prof. Linfield if he has made any experiments or knows of any results on the relative values of the crops where the clover has been turned under, say the second crop in the Fall and where it was cut off and simply the sod turned. It seems to me the question is this, if there is any difference in the crops shown by experiments where the two have been performed.

Prof. F. B. Linfield: I haven't any data upon that point. The man to whom I have referred to before—Mr. T. B. Terry—for his potato crop always plowed under the second crop of clover, in the east the second crop of clover is not as big a crop as with us. I am very doubtful if you could afford to plow under a ton and a half to two tons of clover, valued under average circumstances at five dollars per ton, ten dollars per acre. I am moreover, doubtful if it would pay in return to plow that amount of crop under, although at the same time I will say I have no experimental data to base my conclusions on upon that point.

Prof. M. J. Elrod: Well, I am doubtful also in regard to that point, that is that plowing the crop under would not increase the yield. Now, as I understand the philosophy of clover growing, the bacteria in the roots are nitrogen-fixing bacteria. The products which are serviceable in making flesh and muscle are the food products which contain nitrogen. The difference between the proteids and the carbo-hydrates is simply the difference between nitrogen and oxygen. The value in these plants is the production of fixed nitrogen which is used by the plant in its growth and that gives the plant the food on which it can make its growth, and that makes the clover and the alfalfa a val-

uable food product. And I believe the experiment station people all over the country and others claim that alfalfa is one of the best food products there is. Now, if it is available as a food product for an animal, would it not be available as a food product for a plant? That is to say, if this top is turned under and it contains so much nitrogenous material—a large part of it, it is true, may be needed by the plant to produce seed—but if there is so much nitrogenous material in the leaf, and that is turned under, is it not reasonable that that will give additional growth to the crop that is grown upon it the succeeding year? As to whether there would be sufficient remuneration for this additional turning under of clover to compensate for the crop is another question, but I am satisfied that the turning under of the clover will give a largely increased yield. If there are experiments to the contrary, of course I will yield.

Prof. F. B. Linfield: Of course it may not apply to such crops as potatoes and roots, but the difficulty we have had is in having the ground too rich in nitrogen, the crop falls down; under those circumstances the plant does not mature, and therefore you do not get as big a yield. The greatest trouble is that after clover two years our soil is too rich. So rich that our barley crop after clover nearly always falls down, which of course cuts down on the yield and we have got to consider those things in working out our returns. It is a question of dollars and cents. How much are we going to get out of it? In this case we didn't get so much because the soil was too rich.

Prof. W. W. Wylie: We find an objection to turning under the clover in our valley is that it makes the ground too light for irrigation, that it requires so much water; it would be like turning under straw; it makes the ground too porous. You know when we turn the ground over for clover for two crops, we do it in the Fall or Spring, and it does not have as much time to settle as with summer-fallow; and when we plow up a field that has been in clover for two years, then it is a great study what crop to put in that will stand up; barley won't do it and oats very often won't do it, the ground is so rich; and we usually have to sow wheat because it is more likely to stand. It is a study to know what crop to put in that will stand up because of the richness of the soil; and the other objection, plowing under a heavy crop of clover makes it too difficult for irrigation; it is too porous.

Prof. F. B. Linfield: When you turn under either clover or strawy manure, it leaves the ground with a space between the furrow you turned over and the sub-soil, with loose hay, or manure right between the furrows in this space. Now you have an air-space there. If you have a wet winter and had plowed the land in the Fall, it may pack down solid enough so as to have communication between the sub-soil and the surface soil; if it does not, and the connection between the two is broken, the water can't come up through the ground; it acts like a mulch on the ground, and the ground will often dry at the surface. There is therefore this danger to be avoided in our irrigated districts; we have had that experience on the station farm.

Mr. R. N. Sutherlin: May I ask how long it takes a clover crop or alfalfa turned under ordinarily to rot and decay to become a fertilizer?

Prof. F. B. Linfield: It will depend on the amount of rainfall you have. In the east, where they have abundant moisture, it will rot very quickly. Suppose you have a winter where we have no water and the ground is dry, then no decomposition will take place. It can't. So it depends on the condition; if we have a damp winter it will rot all right, and if a dry winter it will not rot.

Mr. R. N. Sutherlin: Winter like the present,—if we had turned over a clover field this Fall, for instance, next year it would be as dry straw, wouldn't it?

Prof. F. B. Linfield? Yes. Isn't this one of the questions you must take into consideration?

SUGAR BEET GROWING.

By W. M. Oliver, Dillon, Montana.

The production of sugar beets and of beet sugar in the United States is now assuming such proportions that with the increase of factories and the marked popular interest it has become one of the leading subjects demanding the attention of the farmers. There is probably no industry that has developed so rapidly and now absorbs so large a share of public attention in this Inter-Mountain country as has that of sugar beets.

Many of the experiment stations have carried on experiments in culture of sugar beets for several years past with very encouraging results.

These experiments have shown that there are very wide areas in the United States adapted by climate and soil to the growth of sugar beets and that they attain their greatest perfection in what might be termed the north temperate latitudes. These tests show that the lines should not be drawn too closely as beets are grown of excellent qualities in regions of very dissimilar climatic conditions, in fact, it appears as though the greatest requisites are sufficient length of season and plenty of moisture during the growing season. Another important condition is an absence of moisture during the ripening and harvesting of the crop. We find that the very best possible conditions exist in this mountain region where we have plenty of water and the climate is all that can be asked for the maturity of the beet crop.

There is no question but that under a system of irrigation beets attain their highest perfection. The beets grown in Utah do not have as great a per cent of sugar as those grown in Idaho, and I find from Bulletin No. 33 of Montana Experiment Station that the average from 65 tests in this state was 17 per cent sugar and 84 per cent purity. This is much above the average. Montana seems to be especially adapted to the growth of root crops. The only difficulty is to keep down the growth and prevent the formation of too large roots. The general experience is that sugar beets are not especially hard on the soil and that wheat and oats invariably do well after beets.

As soon as the beets are up they are blocked out and thinned. Blocking consists in cutting out the beets so that they stand in bunches from 6 to 8 inches apart in the drills. This is usually done with a hoe with a blade either 6 or 8 inches wide. Thin-

ning is very tedious work and should immediately follow the blocking out. It consists in removing all but one plant from the bunch. This is an expensive operation as it has to be done by hand. Next to thinning, weeding is usually the next most expensive operation as this is also hand work.

When the beets are ripe they are loosened in the ground by using what is called a double pointed lifter which runs upon either side of the row. They are then pulled and the top is taken off at the line of first leaf. The beets are then thrown into heaps on the ground which has been previously leveled and packed so that they can be forked up and loaded into a wagon without taking a large amount of dirt and rubbish with them.

In addition to the money value of the crop, the bi-products are of no small importance. The value of the pulp as a stock food is yearly becoming better known to the stock raiser, general farmer and the dairyman.

Aside from the direct benefits derived from the production of sugar beets, the farming community gains indirectly better roads, improved farms, and more thorough and intelligent farmers. Population increases, farming lands double in value and the community is prosperous. This is the history of the industry wherever it has been established in a proper location for the growth of sugar beets.

Sugar is a prime necessity of every household and its consumption is increasing annually, not only by the increase of population but by increase of consumption. The yearly increase in consumption for the past two years has been 8 lbs. per capita, or in other words 320,000 tons more sugar was consumed last year than would have been consumed ten years ago had the population been the same then as now.

This amount of sugar equals about the output of the 59 beet sugar factories operating in the United States during the last year. Michigan has the greatest number (16) of beet sugar factories. Although California has less factories (8), the daily capacity of her factories is nearly 2,000 tons of beets more than that of Michigan. The Speckles Sugar Co., Factory has a capacity of 3,000 tons of beets per day. Factories usually aim to run for 90 days.

The factory located at Ogden, Utah is among the most successful in the country. It has a capacity of 350 tons per day

and has enough beets to run over five months or about 60,000 tons of beets.

Idaho has three beet sugar factories. The one located at Blackfoot was removed from Birmingham, New York, being attracted by the climate and the favorable conditions existing. The others are located at Idaho Falls and Sugar City, near St. Anthony. Each have a capacity of over 1,000 tons per day.

I find from talking with farmers from Colorado, Nebraska, Utah and Idaho that they are generally satisfied with beet culture and especially is this the case with farmers who rotate their crops. The soil of Snake River, Valley is fine and the climate admirably adapted to the growth of beets.

I understand that other conditions being equal, those localities having cool nights raise beets of greater purity and of a greater per cent of sugar than in warmer districts. Many farmers in the neighborhood of the Idaho Falls factory plow under their 2d crop of alfalfa which appears to be just the thing to prepare the ground for beets.

The land should be plowed in the fall. As an example of this mode of farming. Messrs. Woodhouse and Gaddie plowed under in August of 1903, a heavy crop of 2d growth of alfalfa and last spring planted 95 acres to sugar beets. This acreage produced a profit of \$22.00 per acre or 30 per cent on the investment of \$75.00 per acre. Another instance was 25 acres which produced nearly 19 tons per acre giving the owner a profit of nearly \$40.00 per acre. Some others did as well and in no case did I learn of any one who did not do well that year who gave his crop proper attention.

This shows that sugar beets properly handled is the most profitable branch of farming and I wish to say to the farmers of Beaverhead County that those desiring a highly interesting work upon sugar beets should apply to the Experiment Station at Bozeman for Bulletin No. 52, which will show that Montana is capable of producing beets of the very best quality. It also shows that there is not any probability in the near future of being an over-production as we are importing over 2,000,000 tons of sugar per year.

I would especially recommend that the farmers of our valley undertake experiments with sugar beets on a limited scale for the purpose of learning the method of culture and to know if our

soils are adapted to its growth. The cost of production for experimental purposes will be repaid if used for food for stock. Sugar beet seed in small lots can be procured from the Experiment Station, Chemical Department at Bozeman, and they will be only too willing to make what test may be desired. They also give directions for planting and cultivating and will be pleased to co-operate with all in determining the advisability of the location of sugar beet factories in our state.

Discussion.

Remark: I would like to ask about an insect that gives me a great deal of trouble with my beets. I would like to know what to do to get rid of them. I believe it is what is commonly called the squash bug. They are blue about an inch long, they come in swarms. They attack grease wood then rag wood. I have tried everything to get rid of them, lime and paris green, etc. They vacate for a short time but come back again and stay as long as the beets are here.

Question: What is the length of the insect?

Remark: Two or three inches long and lasts perhaps a month or six weeks. It is when they first appear they do the most damage.

Mr. Linfield: Where were your beets planted?

Remark: Near the edge of the field but there are no ditches near.

Mr. Linfield: Is the larvae stage in segments?

Remark: I cannot tell as to that. I was not close enough to tell. They seem to live on different weeds, but where they breed or come from I cannot say.

Mr. Linfield: I think I recognize the insect as one common in Utah, but I know of no remedy for them and cannot tell you anything about how to overcome the insect, but I will call the attention of our Professor of Entomology to it, he may know.

Remark: I will send you some of the bugs next year. If they increase like they do at my place the raising of sugar beets would be out of the question.

Mr. Herb Selway: I found the same kind of a bug at my place. They also are found in the garden.

Mr. Linfield: If you send us a sample of the bugs I will look the matter up.

The difficulty with sugar beets is the same one as in the dairy

business, that is labor. You have got to spend about \$30.00 to \$35.00 worth of labor on every acre of sugar beets. If you had six hundred acres instead of ten it would be rather a difficult matter to find your labor. It is not what you can do with beets but how you can make it profitable. T. T. Black down on the Jefferson told me of his experience with strawberries. One year he was going to do a big business with strawberries. He planted twenty acres in strawberries and had as fine a crop as he ever had in his life. He picked about three acres of them. He couldn't find under any consideration good labor sufficient to pick them at the time they should have been picked. He could have sold every strawberry of the twenty acres at eleven cents a box, but he could only pick three acres. That is where our difficulty is.

Remark: We will have to import some foreigners.

Mr. Linfield: I believe that is what they are planning to do in the Yellowstone valley. It is I believe one of the most favorable districts for raising of sugar beets. They are planning to bring in Russians, a family to every twenty acres of land.

Mr. Oliver: I will state this: the labor is a question with the people I have talked with in regard to sugar beet culture. Sixty-five miles from Pueblo they have been using Russians and have got along fairly well, but the most satisfactory labor I understand is the Japs. The railroad company has shipped in Japs during the season. It was necessary to have a great amount of labor. With the Japs they have been able to cultivate the sugar beet.

Mr. Black was located in a locality where it was very hard to get labor. He was unfortunate in being located where he was for that country is well adapted for the cultivation of strawberries.

Remark: I have never raised sugar beets but have had experience in raising cotton and think most of our industries become monopolized by getting foreign people to do the work. I was fortunate enough last fall to hear Gen. Booth, the Salvation Army man and he spoke about the crowded conditions in the eastern states. These poor distressed people could be shipped here and the labor question could be solved without sending to Russia or Japan for help.

Mr. Morse: I believe if small farmers had time to give it their personal attention and this fall go to work and plant a small

amount in sugar beets and take good care of them, any man who has ordinary horse sense can raise good sugar beets if he wants to. If twenty or thirty men would do that, we would find out if their soil is adapted to the crop. We can send the beets to Idaho Falls or Bozeman and have them tested.

Mr. Linfield: Yes, one or two beets would be sufficient to mail and these can be "franked."

Mr. Morse: If we can get twenty-five or twenty men to do that, I will furnish five to ten acres of land free if he will raise the beets, and furnish the manure free also.

Mr. Linfield: That is a good proposition for some one. Where you can grow alfalfa you can grow sugar beets. You can grow alfalfa well I think you can grow sugar beets here. The only difficulty is getting the acreage of beets; with that you can get the factory.

Mr. Oliver: Don't understand that we can raise beets without some work. Don't plant them too close together. You don't want to have them too large. There are too many impurities when they grow too large. If you can average 16 tons to the acre you have a good crop. I found that the per cent of sugar in a Montana beet was about 17.5 per cent.

Question: Do they require much water?

Answer: They require a good supply of water.

Question: What about the alkali soil?

Answer: They will grow well in alkali soil if not too strong.

IRRIGATION.

IRRIGATION CANALS.

By Prof. E. Tappan Tannatt, Irrigation Engineer.

In discussing the question of Irrigation canals, methods of construction, etc., it will be impossible in the short time allotted me, to give you more than a few passing glances at some of the fundamental principles underlying the work, a little inside into the conditions which must influence the engineer in making his designs, and a few facts and figures which practice has proven to be correct.

It seems a very simple matter to be able to construct a canal or ditch to convey water from a source to irrigable lands below. If we do not care about securing the best results for our money, this assumption may be correct in a way; but if we desire to secure in this work the same standard of value which we would require in our machinery, or attempt to secure in our investments, we will find it a very different matter.

The engineer in such matters, as in all engineering work, has or should have but one objective, namely, to secure the highest possible efficiency with the least cost of maintenance and construction. To accomplish such a result requires both study and experience.

In designing an irrigation canal, one of the first problems which confronts an engineer, after securing the data which enables him to judge of the approximate size of the future ditch is,—at what point in the mountain stream shall he divert the water from its natural channel? This question seems simple. Let us look into the same a little. First:—We will suppose that it takes a certain sized ditch, with a certain grade to deliver the amount required. He who has not studied the question will at once say—"Easy enough, start at the land and run a line of levels back into the bed of the stream, giving the proposed ditch the grade calculated; where the line intersects the bed of the stream place your headworks." This sounds all right, but let us see. Will such a ditch give the desired result? Will such a

ditch give the maximum amount of water with the least cost of construction and maintenance? If not, it evidently falls short of the mark, and is not the line the engineer should select.

Let us examine a few known conditions. We recognize that if we tap the stream low down in its course, we will secure all of the water available from the watershed above, and that the lower down we go the greater will be the drainage area. By keeping down we necessarily must have a less difference in elevation between our headgates and the land to be irrigated. This means a low gradient; and a low velocity of the water in the ditch. A low velocity means a corresponding increase in the size of the ditch, with more material to be excavated. A low velocity means that a greater amount of silt will be deposited in the ditch; and the lower down the main stream we tap the same the greater will be the amount of this silt carried by the water and the greater the growth of weeds. The greater the amount of deposited silt, the sooner the ditch will fill up and the greater will be the annual cost of removing the deposit. A low velocity means that we must expect seeds brought down by the water to find lodgment on the banks, and the quiet water favors the growth of grass and weeds. The more obstructed the ditch, the less the amount of water delivered. We begin to see that the low-level ditch promises a high cost of construction and maintenance, which does not harmonize with our ideas of design. We decide that we will go up the stream and take the water from higher up.

Again we meet difficulties. The higher we go the more difficult the construction becomes, as a general thing. The former earth construction gives place to rock; the low trestles and flumes give way to the higher and longer ones; the watershed is reduced, and the runoff from the same correspondingly less. We find that the water has less silt, but instead of being troubled on that account we find that some portions of our ditch are subject to cutting on account of the high velocity of the water. The length of the ditch is greater, and the consequent seepage loss considerably greater. Our water supply is reduced at both ends of the line. We begin to think that there may be something in ditch construction after all. Here we have two lines. Neither is satisfactory: neither gives the ideal we were striving to reach. Wherein all the length of the stream can we find the condition we seek?

We decide to go half way between the two ditches, and again use the constant grade. Again we are in trouble. In some places our ditch cuts and in others fills with silt. The grade is the same, why should this occur?

We have considered but a few of the many points in canal construction, and have found that we have many questions to answer. How many will we have to answer before the entire design is finished? As before stated, only by years of study and practical experience can we answer all of the questions which come up in canal construction. We can however, go ahead and without this study and experience, or the employment of the same, construct our canal, and ever after pay the penalty for our lack of foresight, in the form of cost of maintenance.

As before stated, it will be a matter of impossibility for me to give you at this time a complete solution to this problem. If I can assist you, even little, in pointing out some of the features of improvement, or can prove to you the advisability of not attempting to accomplish a class of work (without the right kind of assistance) which requires special experience and education, I shall feel that my work has not been entirely in vain.

In all irrigation work, the first consideration is the amount of land to be actually irrigated. In all irrigated sections a very large amount is to be deducted for waste and non-irrigable lands, such as pastures, barnyards, roads, lanes, etc., etc. Generally it is safe to estimate that one-half of the available land below a canal will not be irrigated. There are always portions of the lands which are not being irrigated at one and the same time. These points should be considered in the design of an irrigation system, as well as the losses from seepage, evaporation, etc.

With the above questions settled we are able to ascertain the capacity and size of the ditch or flume to be constructed, at least we are able to arrive at an approximate idea of the same. The question of grade is one which must be settled from an examination of the local conditions, formation, etc. We know that the mean velocity, times the area of the cross-section, gives the quantity discharged. Whenever we increase the velocity, we can decrease the amount of material to be removed from the excavation of the ditch.

Experience has taught us that certain materials will stand, without cutting, heavier grades than others. We find that a

velocity in excess of two feet per second will oft times cut the banks of the ditches unless protected by riprap, or some other material; while rock excavation will stand a very material increase in velocity without injurious results.

We find from practice, that the following velocities are required in order to enable the water to move the corresponding material:

- .25 feet per second moves fine clay.
- .5 feet per second moves loam and earth.
- 1.00 feet per second moves sand.
- 2.00 feet per second moves gravel.
- 3.00 feet per second moves pebbles one inch in diameter.
- 4.00 feet per second moves spalls and stones.
- 6.00 feet per second moves large stones.

Generally in an irrigation project, the question which stands first is: "How cheaply can the work be done?" Although this is a desirable feature in many ways, yet we should not apply the question to first cost only; rather, "How cheaply can we deliver the water during a long period of years." In other words, How can we make the cost of construction, plus the annual cost of interest and maintenance, as small as possible? The mistake is too often made, both by Engineers and less experienced persons, of losing sight of the annual cost of maintenance, and considering only the first cost. In some cases, this may be absolutely necessary, but in most cases it would pay better, in the long run, to borrow the money for good construction.

I feel, that in recommending to the people of this State, and in all states for that matter, the first step advisable in considering an irrigation project—Secure the services of an experienced engineer. This does not mean that an engineer of broad experience need be employed for all of the work, but that before construction is commenced, the ground and plans be gone over by such an engineer for his recommendations and approval. It will pay in every case in the long run. I do not believe it possible for the Experiment Station, in the course of a few lectures to make the matter of irrigation sufficiently clear to the average citizen, to make the above advice out of place, although I trust that we may be able to benefit you in a small way.

In designing an irrigation system, one of the most important parts are the headgates. A poorly designed or located

headgate may mean poor results from an otherwise well designed system. Even the angle the headgate makes with the main stream makes an immense difference. By this alone we are able, oft times, to either be constantly fighting deposits of silt in a canal, or to take water from the stream comparatively free from silt. In designing the headgate it should be so placed as to take water from an eddy in the main stream if possible. Where this is not possible, suitable arrangements should be made to separate the silt-laden waters from the clearer. This can be accomplished, either by reducing the velocity of the water for a short distance, and removing the deposits from time to time by special washout gates, or by using the surface waters only, and allowing the heavier waters to pass out through a specially designed pass. In some ditches, it is advisable to carry the silt through to some point where it can be removed to better advantage. Such a result is advantageously accomplished where the ditch line crosses a small draw or ravine.

In crossing a draw, two methods are usually employed; either to run the ditch up the one slope of the draw and into and across the bottom and thence out along the opposite slope; or to cross the draw direct by flume, trestle or inverted system. Where such a place occurs in the line of ditch, oft-times a cheap form of dam can be constructed just below where the ditch strikes the draw, thus forming a reservoir above the dam, and the waters of the ditch allowed to pass into this reservoir. The advantage of conveying the water with the silt to this point, is that it enables the use of a higher velocity, and a corresponding lessening in the amount of excavation necessary, also the construction of expensive headworks. The water from the reservoir is taken up by the ditch on the opposite slope without loss of grade. Through the bottom of the dam, or in some convenient place, a blowoff pipe and valve is placed, and the deposit of silt taken from the reservoir from time to time. You will recognize that the reservoir acts as a settling basin for the waters, which otherwise would carry the fine earth into the small ditches and laterals below, causing the usual trouble incident to such conditions. One who has not had experience in irrigation work, will more realize the trouble and expense which is required in the removal of silt, annually from a poorly designed irrigation system. We must also remember that silt deposits in the field and in the small

ditches means the corresponding planting and growth of weeds brought from other localities by the water.

In designing an irrigation system, except in special cases, it is very inadvisable to attempt to hold to any one special form of cross section or grade. In this work alone the experienced engineer is oft times able to save the owner more than the amount he receives from his services.

The question has often times been asked of me: "At which end of a ditch, or where should construction begin?" This, as with most other irrigation construction should depend upon the conditions. Generally, where the work is contracted, or of considerable extent, the ditch is opened at several places at one and the same time. A very satisfactory, and oft times the cheapest method of construction is by the use of dredging machinery constructed on a scow or float. In such cases the construction commences at the headworks, and sufficient water is turned into the ditch to keep the scow floating. This method has the double advantage in that the muddy water assists in silting up the sides and bottom of the canal, thus reducing the subsequent loss by seepage.

Duty of Water.

At the present most irrigators are giving much time, labor and attention to the question of, "Duty of Water." All of this information is of great value, not only to the agriculturist but to the Engineer. It seems to me, however, that an even more important problem presents itself for solution, in the matter of "seepage."

In most of the canals and ditches of the state, so far as my information goes, the seepage loss ranges from 25 to 70 per cent of the water passing the headgates. This water in many cases passes down to the lower levels without doing a particle of good to crops, and soon produces a necessity for expenditure in drainage systems. This same water, if kept within the confines of the ditch, would greatly increase the efficiency of the system, as well as do away with many of the complaints on account of the shortage of water.

The question of "Duty of Water," is more of a question for the irrigator as to what is the quantity of water required to produce a maximum crop upon his special field. The question of "seepage" is a question of interest alike to the irrigator and the

engineer and a satisfactory solution of the problem means an increase in the acreage of irrigated land under the canal, and the decrease in the expenditure for drainage. The question of "Duty of Water" is one which can be most completely and satisfactorily solved by the farmer himself; the question of "Seepage" will require the co-operation of the two parties and the records of the two.

The value of seepage waters may be illustrated by quoting from the report of the seepage investigations made by the Colorado Experiment Station, as given in their Bulletin Number thirty-three.

"In the valley of the Poudre the seepage water is worth at prices at which sales have already been made, from \$300,000 to \$500,000 at the least and the waters of the Platt from two to three million dollars. It is of corresponding importance in the valleys of Clear Creek, St. Vrain, and others. Of such importance already, it promises, if the deductions of the bulletin are correct to be of still greater importance in the future, and in the development of the State."

Every irrigator should have some means of ascertaining the amount of water applied to the crops, and by keeping from year to year a record of such supply and the corresponding yield, the irrigators will derive information of value, far in excess of the figures presented from other fields and locations, which may have nothing in common with his conditions. The duty of water in this field, for a certain crop, may be entirely different in a second field some distance away, or even adjoining. The information in this line, given out by the Experiment Station, may point the way to the results, and enable the irrigator to ascertain the relative duties for the different kinds of crops, but will not in all cases give the result which most nearly fits each individual case. The farmer and the irrigator can be of more assistance in securing this information than in almost any one item of interest to the irrigating public. In order to make the data secured of value, not only must the amount of water applied to the crop during season be known, but also the acreage and the yield. The Station has in the past assisted the irrigators of the State in securing the amount of water applied to the crop but in many cases have been refused by the parties so assisted to give the figures of the amount of yield from the field. The re-

sult has been, on this account, of little value to the Station and the public. The amount of water applied to the crop is known per acre, but whether or not the resulting yield was a maximum is not known, and hence the report would be valueless to others.

The question of "seepage" I consider a more important and vital question to the public and the state. I have examined irrigation and adjoining drainage systems, where if one-half of the money expended in drainage had been applied in the first place in making the irrigating ditch water-tight, better results would have been obtained. The trouble was that the drainage system was owned by one party, the canal by another, and neither party seemed to realize the mutual benefit of co-operation.

Up to this time, and owing to my short residence in this state, I have not been able to examine many of the irrigation and drainage systems of the state, at the same time, I am convinced from records in my office, that just such conditions exist at the present time within the State. What will be the result, and how much money will be expended in drainage, when all of the irrigable lands of the state are under water? What is required in such cases is, the advice of the experienced engineer, careful study and investigations with a view of finding a cheap method of making our canals and ditches water-tight, and the application of the Golden rule.

Before opening an irrigating system, it is well to ascertain the level of the ground water in each locality. This can be done by ascertaining the distance to the level of the water surface in the wells from the surface of the ground. After the water is turned on, it is well to note the rise of the ground-water level from time to time. A rise in the ground water level, indicates two things: 1st excessive use of water in irrigation, and second, excessive seepage.

The ideal condition of irrigation is to apply just such a quantity of water to the land as to have every drop of the same do as much in producing plant growth as possible, and the water applied to the land which finds its way to the sub-strata indicates by its amount, or inability to properly irrigate. A rise in the level of the ground-water indicates that the sub-strata is being filled by water which is not only doing little if any good, but may be a serious menace to the health of the community. When the level of the ground water reaches to

nearly the surface, it means a drainage system at least, and a possible destruction of the land from alkali.

In some localities a sub-strata of gravel exists, which acts as a blind drain to take off the excess of irrigation water; and land so protected will not suffer as much as land with a clay, or otherwise impervious sub-strata.

Where a clay sub-strata exists, the community should be doubly watchful of the ground water, and the rise of the same should be kept as small as possible, by the careful use of irrigation water, and the watching of seepage conditions.

I call to mind a section in the Yakima Valley, Washington, where but a few years since, water in the wells was from sixty to one hundred feet below the surface, and typhoid fever was not known in the valley; this was before irrigation was practiced. Shortly after the completion of the Sunnyside Canal, and the commencement of irrigation, the water in the wells commenced to rise, and with the rising came increasing cases of typhoid fever. Now the wells are nearly surface-full, acres of land formerly selling from two hundred to five hundred dollars per acre, are non-productive on account of black alkali; the doctors are kept busy attending typhoid fever patients. This condition was brought about by the extravagant use of water by the farmers, and the fact that little or no provision was made in providing against seepage in the main canals. To-day an extensive drainage system is in process of construction, made necessary almost solely on account of this lack of foresight.

I understand that new irrigation systems are in progress of construction in this section. I am not as fully acquainted with your conditions as I some day hope to be, but I would by all means advise, especially if you have a clay sub-soil, that you provide against the conditions of seepage and excessive use of irrigation water, no matter how abundant the supply.

The farmer who uses an excess of water, because it costs him no more than a lesser quantity, is paying dearly for his extravagance, and generally he will soon more than pay for the same in doctor and drainage bills.

A number of methods have been adopted to prevent seepage losses, all with more or less satisfactory results. Undoubtedly a well designed concrete lining gives the best results in canal construction, but puddling with fine, clay, ashes or the like, is of

great benefit. Wood or coal ashes especially the former, offers a most excellent material for closing the interstices in semiporous ditches. I have also used cement, applying the same dry, and in such a manner as to cause it to pass down into the gravel and set. The result of my first trial of this method was successful beyond my expectations.

During the past months I have received numerous letters requesting advice as to the discharge of certain flumes, ditches, drains, or the like. In many cases the data furnished has been so incomplete as to not even give an approximate idea of the answer to the question. Although there has been much information acquired in hydraulic work in the past years, at the same time the hydraulic engineer cannot now, nor will he ever be able to accurately figure the discharge of a ditch, flume or canal, when he is simply advised the size of the flume, or ditch, and the grade of same. Different materials, give different rates of discharge through the same sized section. Earth whether clean or foul; rock, gravel, rough or smooth lumber, old or new pipe, all give different results for the same section. To advise an engineer of the size and grade of a ditch, flume or pipe, and to ask him to advise you as to the discharge, is asking him more than he is justified in giving. The engineer must not only know the above data but he must know the conditions which exist, or are expected to exist. He must know the character of the banks, shape of the section, depth of the water, and numerous other points, before he is qualified to answer; in other words, he must see or know the conditions.

In order to answer some of the questions propounded, I have taken the figures given and have assumed, and stated that I assumed, that certain other conditions have existed, or would exist, and have returned a reply. In order that such answer may prove by results, the conditions so imposed must be carried out exactly. We should not modify our conditions and then claim that the engineer was at fault in his figures.

I mention this at this time, for the reason that I dislike very much to be called upon to make a calculation, and apparently, either dodge the question, or not meet the conditions which exist, and which are not furnished me. The engineer who loves his profession, has some pride in his results, and dislikes very much to be condemned for trying to advise in a matter which by rights

he should have refused to assist in, until all conditions were understood by him; or when he has expressed conditions which were not carried out.

Most hydraulic problems are more or less lengthy and complicated and I feel that to advise this meeting at this time, and in the manner I have, will result in no harm, and possibly aid in securing a better understanding of the work of my Department.

CO-OPERATIVE CANAL CONSTRUCTION.

By W. M. Wooldridge, Hinsdale, Montana.

In attempting to handle the subject assigned me, I assume that what is required is to tell as briefly as possible how canal construction on a comparatively large scale might be accomplished without the aid of the state or general government.

Generally speaking, there are two ways in which this might be done. One is to undertake to secure capital, and contract the work done, then take chances on reimbursement by renting or selling the water to the farmers whose land might be reached by the canal system. The other is to persuade these land owners themselves to undertake the construction of the canal by their own labor and that of their teams.

The first mentioned plan is the method adopted many years ago throughout the entire West, and which caused such universal financial loss on the part of those advancing the money. This plan is usually known as the "Water Right" system, and millions of dollars have been utterly wasted and lost, destroying confidence in irrigation investments, and so rare are successful projects under this plan that they are notable by their absence.

The second plan is generally known as the Co-operative plan, and so generally successful has this manner of construction become that it is rare to note an exception.

If we are dealing with settlers located upon government land for which they have not yet secured patents, and it is desired to advance them money, this can be done with safety if judgment is used and the parties advancing the money are assured that the money so advanced is actually used to carry on the work. The work or interest of the respective land owners in the canal construction is usually sufficient security for any reasonable amount so advanced.

The first step is to determine whether there is sufficient water supply available. Now many western men think that a perennial supply is absolutely necessary. This depends entirely upon the character of the land to be reclaimed. Take for instance the character of the soil found on your great Missouri Valley Slope, varying in depth from a few to many feet, without any strata of gravel, where it is impossible for the water to be wasted through such a gravel formation, I would feel fully justified in undertaking the construction of a canal system to cover such land even though I was satisfied that the only water obtainable would be from the melting snows of the springs. But in many such locations will be found coulees and depressions which can be utilized by damming up the outlet and storing the water for later use, but it is a good plan under all circumstances to fill your land full of the waters from the melting snows, then take chances on a later irrigation. In fact in North Montana we have discovered from actual experience that land so early irrigated gave the largest hay crop. Of course grain land should be watered later when possible.

Being satisfied of your water supply, the next thing would be to employ a competent civil engineer to make a preliminary survey to ascertain if the land has sufficient fall to enable you to take out a ditch. I presume the principal difficulty would be to obtain sufficient fall. Many of our Montana friends where the difficulty in canal construction is to overcome an excessive grade, would tell you to merely take a homemade triangle and spirit level and lay out your own canals. I have even noted bulletins published by our government advising farmers to do this and telling them how to do it, but when you are operating in a comparatively level territory like North Montana it will be found that the principal difficulty will be to obtain sufficient fall to permit water being diverted from the streams. In the mountain country a small canal with an excessive fall, or "grade," will carry a great deal of water, in fact it can be stated that the less grade obtainable the larger must be the canal for a given water supply.

In our part of Montana we have canals run on so slight a grade as one foot to the mile, and none with a grade of over two feet to the mile. This requires not only painstaking and competent engineering, but careful canal construction as well. Think of it. This is only slightly over one thirty-second of an inch to the rod.

How utterly useless would the unaided eye or a spirit level be under such conditions.

Many fine irrigation projects have been spoilt, owing to incompetent engineers. By all means engage some engineer who has had actual experience in laying out irrigation canals. Have him give you reference to canals in successful operation which were laid out by him. Remember that, while \$10 or \$15 per day and expenses for such an engineer might seem high, when possibly a surveyor might be secured at \$5, yet it is great economy to employ the best man obtainable. Remember, it is upon his recommendations that possibly thousands of dollars' worth of work will be done, and nothing is so disheartening as to learn after this investment has been made and when water has been turned in that it will not carry it, and your investment is a dead loss. I know of several such enterprises, some costing as high as \$20,000.

When survey has been made, follow the instructions of your engineer to the very letter, and it is well to have him make a weekly inspection at least. Employ some competent man as foreman.

After you have decided to actually construct the canal system, incorporate your company. Let each share of stock represent sufficient water for one acre of land. Let each stockholder or land owner pledge himself to do work and pay his proportion of any cash expenses proportionate to his acreage holding, or so much of it as he may wish to irrigate.

Assuming that 10,000 acres are to be irrigated and the engineer's estimate shows that the cost will be \$30,000. This would be \$3 per acre. Each man and team would be credited \$3 or \$4 per day of ten hours, or 30 to 40 cents per hour. At 30 cents per hour it would require 160 days' work of ten hours to pay the cost of reclaiming 160 acres. This would be the outside cost per acre. We have done it for less in Northern Montana, and our expenses are greater than it would be with people further east.

At first glance \$30,000 seems like a great deal of money for a community of farmers to pledge themselves, yet divided in this way it is a small sum.

By all means keep down cash items of expense. We have found it best for the canal company to only own the grader plow, but let each man furnish the other tools he needs. If work is over a mile from home, insist upon each man doing an honest

day's work and credit him for actual time worked. Also insist upon every stockholder desiring water for each 160 acre tract to put at least one team and driver upon the construction work and keeping it there until completion.

Under some conditions it might be advisable to let contracts at so much per cubic yard to the several stockholders rather than employ by the hour, the engineer to decide the yardage.

The items of cash expenses need not be large, the salary of the engineer, lumber and a few incidentals. It should not exceed \$1 per acre.

On our Rock Creek canal near Hinsdale, Montana, which was finished this season, we employed a larger grader. This cost our company \$1,400, and was pulled by a traction engine. It is also made to be pulled by twelve or sixteen horses. It can be operated cheaper by horses, but it is hard on them, especially any but well broken work horses. It is guaranteed to move 1,000 cubic yards of earth in ten hours, and can only be used on canals twelve feet or over in width, and as deep as three feet. Generally speaking the common slusher scraper is about the best tool to build a ditch with.

A capable engineer will avoid fills or embankments, also cuts over six or eight feet deep, where at all possible, even if length of canal is added to.

After completion of the canal, during irrigation season, a ditch rider is employed to measure off water to each individual entitled to it.

Your board of directors of the corporation should consist of not less than five persons, and should serve without any compensation. In our several canals in northern Montana none of the officers receive any compensation, excepting the secretary, who has charge of the books, who is paid only a small sum, say \$100 per year for such a canal.

No water should be rented to any non-stockholder. Shut out all forms of speculation in water. If any individual wishes water, compel him to become a stockholder in the canal.

Our cost of maintenance in Northern Montana averages from 12 to 15 cents per acre per year, which includes the salary of the ditch rider. The state should exempt all such co-operative canal companies from any form of taxation whatever. The land should be taxed as improved land only.

The question which will naturally arise in your minds is whether the farmers would be justified in going to this expense?

The difference between a partial crop such as is possible without irrigation during an ordinary year in this portion of the state, and one produced by the aid of irrigation would be enough to pay the entire cost of irrigation in one year.

It has not generally been recognized that in those portions of the United States where irrigation is an absolute necessity, they have been unusually favored. Where we have those long, bright, sunshiny days, with seldom an excess of moisture, there crops can be secured in all their perfection if irrigation is practiced, with yields so great that the eastern farmer cannot credit our statements, and in order to be given credit for reasonable truthfulness we are often obliged to scale down our figures.

Again, when irrigation is practicable, your farmers should not attempt to compete with staple farm crops, such as wheat, oats, etc., but grow those greater revenue producing crops such as alfalfa, sugar beets, fruit, vegetables. Even by practicing crop rotation it is possible to easily double the grain yields, so it pays immensely to grow even grain. I noticed a paragraph a few days ago in one of our leading Montana papers that Carbon County, Montana, was shipping wheat to the Mandan mills. I was told of a farmer in that county who raised ninety bushels of wheat per acre last year, so that paid.

INTENSIVE FARMING BY AID OF IRRIGATION.

By Prof. F. B. Linfield, Director Montana Experiment Station

I have been west in the arid belt of these United States for eleven years and this is the first occasion in that time that I have had the pleasure of addressing an audience from the humid region. The west is a country of magnificent distances and were it not that our pure clean air brings the distant near, and the western spirit keeps warm good fellowship, even among neighbors miles apart, we would at times feel lonesome. It was with pleasure, therefore, that I embraced the opportunity to visit you, to exchange experiences and to learn, each from the other, the successes and failures which make up life's experiences; on the farm or elsewhere, the stepping stones to progress.

I am to talk to you about what irrigation means to agriculture; to relate to you some of my experiences in that western arid country. Many of you, perhaps, have visited these arid states, but there are perhaps many others who have not, and probably few have climbed the rugged mountains or tramped over snow fields in July or looked down and across fertile valleys and at distant snow clad mountain peaks, thirty, fifty or even a hundred miles away. These mountains, often wooded at the base, projecting their bald crowns into the clouds, often extending peak after peak for scores of miles, are nature's reservoirs. Here the snow piles up, dozens of feet high, to be thawed by the summer sun and then to find its way through and over the ground to the fertile valleys below and beyond.

These valleys, too, filled up chasms between the mighty peaks of by-gone ages, the debris of the disintegrating mountains. They have a soil warm and porous, deep and rich in mineral plant food. The light rainfall has aided the dissolving of the rock, but has not washed away the dissolved material or packed the subsoil. In many places vegetation has been light and humus will be the only soil deficiency.

We have an arid country, the rainfall being only from fourteen to eighteen inches per year, only about half that of the humid east, and yet, if we are to believe the results of our crop experiments, it is sufficient, could we use it all, to grow very large crops, and it does. It will depend on when the rain comes. The period of greatest rainfall in Montana is during the late winter and the spring months, frequently extending into June and July.

The deep retentive soil drinks in and stores this moisture so that early maturing crops generally ripen and yield abundantly. The later summer and fall are dry so that forage crops and grain cure perfectly and easily. Again, the weather is not "sulky"; it storms hard at times, it fusses and fumes, but when it has worked off its temper, the sky clears at once and again presents a smiling face.

But it is of irrigation you wish me to talk. As I have thought over this matter of successful crop growth (and this must be at the base of all our agriculture, whether our ultimate aim is plants or animals), it has appeared to me that there are five main requisites to be considered.

First, good seed; second, good soil in proper tilth; third, a proper amount of moisture throughout the season of growth; fourth, proper temperature; fifth, abundant sunshine.

As memory carries me back to boyhood days on the farm, I think of the many times that I questioned why all this plowing, cultivating and manuring, hoeing and draining. The work of the farmer seemed a game of chance, a haphazard throw with nature, with the dice frequently loaded against him. My after-study taught me that law was the order of nature—there is a cause for every effect. But left to herself nature's results are generally crude and unsatisfactory to man, and our efforts should be to control, guide and direct nature's forces that they may better serve us.

It is in this direction where our colleges and experiment stations lend a helping hand. Delving into nature's hidden mysteries, they wrest from her the secrets of plant and animal life and growth, and with the added knowledge comes greater control over nature's forces, and added returns to the farmer's coffers. Man in the light of human needs has improved on nature's products.

Referring again to the requisites of plant growth, I find that in the humid region the farmer has control first over his seed; second, the fertility and tilth of the soil; third, the temperature of the soil, to a degree. But in arid regions the farmer adds yet another factor to this, viz: The control over the moisture. Because of this, too, the irrigator has greater control over the temperature of his soil than in humid districts. Now, those of you who have studied the matter know that water is very essential

to plant growth. (See Prof. King's experiments, of Wisconsin Experiment Station, and the ninth and tenth annual reports of the Montana Experiment Station.)

My thesis then is, that when given more complete control over the forces that make toward crop growth, providing these are intelligently used, the better the crop. With irrigation water man's control is much increased. Incidentally, I might also add that the losses due to carelessness and ignorance are also greater, as is the difference between the best and poorest crop. Let me illustrate. For six years the Experiment Station at Bozeman had carried on a rotation experiment; a six year rotation, one acre for each crop. The cycle was completed in the season of 1902, and the spring of 1903 the whole six acres were sown to oats. We had then oats following peas, following wheat, clover, barley, sugar beets and oats—the six rotation crops of the year before. No manure had been applied to this land for at least seven years. Let us look at the results as given in the Tenth Annual Report of the Montana Experiment Station:

Peas land seed to oats gave.....	160 bushels per acre
Wheat land seeded to oats gave.....	46 bushels per acre
Clover land seeded to oats gave.....	90 bushels per acre
Barley land seeded to oats gave	45 bushels per acre
Sugar Beets land seeded to oats gave..	85 bushels per acre
Oats land seeded to oats gave.....	64 bushels per acre

A student came to me one day last spring for seed oats, but he thought our price too high, so he took a 10 pound sample to test. He sowed them on one-eighth of an acre in his oat field and beside them his own variety of oats, ten pounds on one-eighth of an acre. His own oats yielded thirty bushels per acre and the seed from the Experiment Station seventy-five bushels per acre.

In no place does intelligence return a higher premium to the farmer than on the irrigated farm.

I grew up in the humid east and received my education there. It has been my opportunity to study the possibilities of crop growth in a number of states where rainfall is depended upon. For eleven seasons I have lived in the arid west, studying the problems of her agriculture and the possibilities of crop growth under irrigation was a subject that appealed to me. My experience would lead me to the conclusion that under average condi-

tions the irrigated farm of the west will yield twice the crop of the eastern farm, that depends on the rainfall for returns, and to this statement I wish to bring a little evidence.

One of the crops by which the farmers in the arid regions swears is alfalfa. In the arid regions under irrigation is where this plant thrives as nowhere else in this country. It is a plant which revels in a deep, rich, loamy soil, where the drainage is good and the water table from four to fifteen feet deep. It thrives best in warm soil and in a warm climate where irrigation water is abundant, but has the ability of adapting itself to high latitudes and altitudes and will here usually hold its own with all competitors. With ample irrigation water supplied, it will produce two or three cuttings in the season and yields four to six tons of cured hay per acre. In the higher valleys, where the snow lays during the winter, clover (Red and Alsike) also thrives and yields in two cuttings from three to four tons per acre. Our experience shows that the cost of irrigating, cutting and stacking this hay is not more than about \$1.50 per ton on the average farm and many make the cost less than this. You can readily see that the crop will give substantial returns at \$5 per ton.

These fodders, cured as they may be in the cloudless skies of the summers of the arid region, possess the aroma and palatability of the new mown hay. On such hay cattle will make good gains without any other feed and in our feeding experiments we have had cows produce 250 pounds of butter fat on alfalfa alone, and with steers we have had gains of one and three-fourths to two and one-half pounds per day in live weight for 111 days, with five pounds of grain as a maximum finishing ration. Steers two and three years old have been finished for market at a cost of from four to four and one-half cents per pound for each pound of gain in live weight. Thus we gain two points in an irrigated country; first, in a large crop and next, a better and more valuable quality of fodder.

Another crop the irrigation farmer is finding profitable is alfalfa seed. Reports from different parts of the state show a crop ranging from one to sixteen bushels of alfalfa seed per acre. Once the alfalfa is well established, the first crop may be irrigated and cut for hay, but the second crop without irrigation is left for seed. In growing alfalfa seed successfully, you must have con-

trol of the moisture, as an excess of water gives vegetative growth and not seed, while a lack of moisture prevents the seed from filling or the plant dries up before sufficient seed has formed to make a paying crop.

It is perhaps in the grain yields that the irrigated districts have the greatest occasion for boasting, and this is especially true of Montana, though I can see no reason why states to the east and west of us may not do equally as well. In this matter I would like to call attention in the first place to the record of the Montana Experiment Station at Bozeman. The station farm is not virgin soil, but is land that for many years was used as a county poor farm and when taken hold of by the Station was considered about the poorest farm in the valley. With some thirty-three varieties of spring wheat grown on the experiment plats, of one-sixtieth of an acre, I find the yield to range from 63.5 to 38.5 bushels per acre on the average for three seasons, 1899-1901, while the crop of 1902 ranged from 29 bushels to 77 bushels per acre.

In 19 varieties of oats, the yield for 1899-1901 was from 107 to 84 bushels per acre, while for the season of 1903 the range was from 174 to 90 bushels per acre.

For the past season there was one plat of one-sixtieth of an acre which produced 101.4 pounds of oats, or at the rate of 188.2 bushels per acre.

Our barley crops on the experiment plats for 1899-1901 ranged from 71 to 40 bushels per acre, and for 1902 ranged from 97 to 29 bushels. The crop of 1904 ranged from 52 to 107 bushels of barley per acre. In our field crops, from a five acre tract last season, we thrashed 304 bushels of wheat. The oat crop has yielded us 129 bushels per acre, as a maximum in the field. Of barley we have had 67 bushels per acre, and our average has been over 50 bushels per acre.

Among our farmers better results than the above are reliably reported. A graduate of the college, whose father is an eastern farmer of experience, told me that their barley crop yielded 75 bushels per acre in a field of 20 acres or more. Our grain dealers and threshers report a large number of yields of 60 bushels per acres. With this grain at \$1 to \$1.10 per 100 pounds, there is a good return for the crop.

Potatoes and roots also do well under irrigation and the irrigated states have established an enviable reputation for the

potato. Colorado and Utah potatoes are known and highly appreciated in the states to the east of them. Montana also brags about her potato crop. As large and fine potatoes as I have ever seen are grown in the Yellowstone Valley near Billings. But the crop does well in all parts of the state, except perhaps in some of the highest valleys. At the Experiment Station we have grown over 300 bushels per acre. But larger yields are obtained in the lower valleys. Irrigation favors a rapid growth and when judiciously applied, the quality of the potato is equal to or superior to that grown in the humid regions.

Montana is not a fruit state year the hardier fruits do well. With no other fruit perhaps is the beneficial effects of irrigation more apparent than with strawberries. Our friend, Mr. Harlan, of Como, could tell us some interesting stories on this fruit. How he sold a quart of strawberries that had but nine berries in it, and yet the box was full, and our friend, Mr. Elrod, will vouch for the fact that four berries picked out of Mr. Harlan's garden placed side by side, covered nearly one foot of space. But Mr. T. T. Black, of Whitehall, Mont., who raises strawberries for profit, reports his crop as averaging 5,000 boxes per acre, and he has picked in a favorable year 30,000 boxes from three acres of ground.

My experience in Utah, as in Montana, would seem to show that the conclusions drawn in the humid regions as to the comparative value of pasture versus soiling, do not hold in the irrigated west. In Utah for four years I carried on an experiment in pasturing and soiling. The result of this work is reported in Bulletin No. 57 of the Utah experiment station.

Two cows, one fresh milch, and the other milking from the fall before, were turned onto an acre of pasture. On the average for four years the acre supported the two cows for three and a half months. The cows received no other feed and were not off the pasture, except twice a month to be weighed. They produced an average of 200 pounds of butter fat from this acre of pasture, or \$40 at 20 cents per pound.

During the same time two cows were soiled by cutting for them green feed and feeding them in the stable. The acre of soiling crops supported the cows for seven days longer than the pasture, but did not produce as much butter fat for the season, returning only 175 pounds, valued at \$35. On the same acre

where the cows were pastured, President Sanborn of Utah had previously pastured two steers for a summer and, from the one acre of pasture, obtained 425 pounds increase in live weight. (See Fourth Annual Report, Utah Station.) In bulletin 31 of the Montana Station Prof. Robert Show (now of Michigan), reports he pastured some eighteen steers and heifers on a small pasture at the Montana Station. Calculated to the same basis as the Utah test, one acre of ground supported four cattle for three and a half months, and these four animals produced 900 pounds of increase in live weight from one acre of pasture. I know it is difficult to realize that such results are possible, even under irrigation, nor would I be inclined to credit them myself, had I not seen the results. But there is a reason for this. When will plants grow most luxuriantly? When the weather is warm and sunny if the moisture is ample. In humid districts during July and August, the warmest season of the year, the weather is usually dry and growth is impossible, but under irrigation the water is available and there is no check to the continuous and rapid growth of the plant.

From the standpoint of the experimenter there is another interesting deduction, which to me seems sound. In a district where conditions are so favorable to the growth of many crops, variations are common and many of these are favorable, from the farmer's standpoint. Thus in the arid region is going to be developed, in time many new and valuable varieties of grain and fodder.

The people in the less favored localities will find here a most valuable source of supply for new seed. This will be especially true of plants but later of animals.

We of the west have scarcely entered upon this field as yet, but it is one that promises large returns to the people of the arid country.

I trust that in these few remarks I have been able to show that the control that comes with irrigation will add much to the acre returns from the irrigated farms. Thus, the irrigated farm is much more valuable than the land of the humid region and even if considerable is spent in getting the water to the land, the returns will justify even a very large expenditure.

HORTICULTURE.

APPLES—VARIETIES—PACKING AND MARKETING.

By Henry Buck, Stevensville, Montana.

The apple of discord is said have caused the Trojan War. And while I disclaim any desire to cause war, I do want to start a discussion that will call out the expressions of persons present on varieties of apples most profitable to raise in the Bitter Root Valley, and the methods of marketing the same.

Apples have been cultivated from pre-historic times, and still the average man has much to learn about their cultivation. In the beginning the varieties were probably two, but now they are so many that they bewilder the novice.

The United States is the leading apple growing region of the world. Apples are raised on a commercial scale extending throughout the north from Maine to the Pacific Coast. As a rule apples do not do well in southern countries, yet we find that New Zealand and Tasmania apples are annually offered in the markets of London during the month of April and May. From this we may infer that it will not always do to say because the latitude of a place is not right therefore apples can not be grown. Economically the apple is the most important fruit grown in the temperate regions. Broadly stated the principle should be, suit the variety to the locality and the purpose for which the tree is grown. In the year 1872, the writer of this paper on a ranch situated near where the little town of Florence now stands, conceived the idea that apples could be successfully grown in the Bitter Root Valley. Not having any experience in this line, and not being able to find any one possessed of better knowledge than myself, I made out my order and sent to a nursery for forty varieties. Hit or miss was the starting point from which experience has simmered us down to perhaps ten or fifteen varieties. Some of the trees then planted are now alive and annually bear fruit.

Because of the many kinds of apples that will grow in the

same locality it is difficult to decide without extended experience which varieties will be the most profitable to plant. Experience is a great teacher and in this paper I only intend to treat of some of the best varieties I have tried for several years, but will not pretend to give the final word, only hope to give a few helpful suggestions that might prove of benefit to persons contemplating planting trees.

The list I now give is not all inclusive, and I hope the growers present will criticise or add to it.

Early varieties: The Yellow Transparent, Red Astrikan and the Duchess of Oldenburg are the best early applies grown. As a fruit, short lived, and while they are not very profitable, the consumer's demand for an early apple must be respected. They should be picked promptly, packed with care and marketed at once.

The later varieties include the Wealthy, Alexander, Wolf River, Haas and Maiden Blush. The greatest weakness of the Wealthy as a tree is its liability to sun scald. It is usually an abundant bearer, and as it bears its fruit far out on the end of the twigs, even to the end of the limbs, the tree thus laden with fruit is apt to break, and your tree is thus lost. The remedy for this as well as all other bearing fruit is to severely prune your tree annually, then your fruit will be large and very desirable for market. The Alexander is a hardy tree, bears a large showy apple, but is not a good keeper.

The Wolf River is also a hardy tree, not a prolific bearer, but brings forth a beautiful apple which sells well.

The Maiden Blush is comparatively a good apple, but being mostly white, counts against its sale, as dealers are generally looking for red apples.

The Haas is a good bearer, is a firm and better keeping apple than the Wealthy, but dry and not carrying much merit.

In the winter varieties we would class the McIntosh Red, Delaware Red, Northwest Greening, Northern Spy, Spitzenberg, Blue Pearmian and White Winter Pearmian. The McIntosh Red leads all in flavor and selling qualities. Of good size, red, leading in many specimens to nearly mahogany color and susceptible of taking on a high polish, a quality that dealers much admire.

The McIntosh tree is a moderate annual bearer, carrying its fruit along close to the larger limbs. The tree bowing with its load of

fruit seldom ever breaks down. If properly pruned for the first five years of its existence it will need little or no attention in this respect thereafter. The fruit may be marketed December 1st, and under ordinary circumstances as late as February 1st. The apple is firm, rich, delicious and will bear shipping to eastern markets. The Northern Spy is a splendid apple and sells readily. The tree is hardy, but a shy bearer. The list would not be complete without mentioning the Crabs. The Transcendent and Hysop are the best ones to cultivate in the Bitter Root Valley. As a rule the trees are hardy and there is no art particularly in marketing them. Caution should be used respecting the planting of many Crab trees, because the present prices and demand may be misleading.

Now I come to the most important item of the apple business, viz: Packing! We are disinclined to learn this part of the business and yet without it the best apples fail to bring a paying price in the market. Absolute uniformity is the rule which should never be varied from. Two sizes should not be put into the same box. Apples should always be packed in tiers. Thus, if an apple in size will fill a box by laying four tiers deep and it takes five apples to make a row across the box, then such apples should be called in size 4x5 tier, and should thus be marked on the box. Three by three are the largest apples and five by five the smallest ones that should be packed. The 5x5 is a poor seller while the 4x5 is a good one. The McIntosh Red should pack about 4x4 and 4x5 if grown under favorable circumstances. The Northern Spy 4x4; Delaware Red Winter 4x5 and 5x5. The Spitzenburg 4x4 and 4x5; the Pearmian, 3x4 and 4x4. The miserable habit of facing apples and placing any size inside to fill up cannot be too strongly condemned. The farmer may think he is marketing his small apples thus to good advantage, whereas it will redound against him in the end like a boomerang. We are told by the trade that in our choice apples, none better are raised. The reason we get small prices for our fruit as compared to imported apples is largely due to the pack. A merchant opens a box of apples to retail, one-third of them are too small to offer to the trade and they consequently find their way to the dump. Another box is sent out to consumer and upon opening the same, the box is fired back bodily to the grocer, asking him why he sent out such truck. Then do you wonder why

merchants will not pay you full price for your fruit? It is now common among merchants of our state when offering apples for sale to ask, are they farmer packed? If so I do not want them. Now, we ask ourselves the question, can not a farmer put an apple into a box as well as anybody? Our answer is, yes; if he would. Apples should be well assorted; bruised, faulty and small ones thrown aside to find their way to cider and vinegar plant. The larger ones sized and packed with care and when promptly and judiciously marketed, the grower will certainly reap his rewards. Use no deception, please the eye and your sale is made.

WINTER APPLES FOR MONTANA.

By C. H. Edwards, Butte, Montana.

Nearly every man growing an orchard to-day has his choice of apples, both Summer, Fall and Winter, and I presume that it is a very hard matter to get a body of men together in the business that will agree upon even four or six varieties of apples for this particular country, but the time has come in Montana, and I believe that the orchardists in this State have now sufficient experience with the varieties they have been propagating to be able to eliminate all of the varieties that may be considered as worthless for winter stock. In all the sections of country where I have had opportunity to work, I have observed that where apple culture has been made a success financially the people have finally got together and made an unwritten law, as it were, that only certain varieties of apples should be planted, and they should be limited to either two or four. In the Hood River Country where they make a success of the Newtown Pippin, they grow also the Spitzenburg and Jonathan, and if anybody should into that country, locate in it with a view of going into the orchard business, he would be ostracized among the fruit growers if he should think of planting anything but those three varieties. Many go and plant something else, but those people who have organized and worked along those lines find it is better, in fact the only way to be a financial success, to have but three or four varieties, and have everybody planting those three or four varieties.

A great many growers in Montana have said time after time we will get too many of certain varieties, and what are we going to do with them? The fact of the matter is in the State of Mon-

tana we will not be able to get too many of any one or two varieties. I find that in the markets a man stands a far better chance who has a large quantity of apples of an inferior quality, to the man who has only a few of the superior; and that is because the dealer knows exactly what number he can get, from that particular man. The price is determined, he knows what the prices will be throughout the season, he knows how long that apple will keep, in fact he knows all about its qualities and is ready to do business. Take the Ben Davis, and its success was simply due to the large number that were planted as a variety. Everybody knows that the Ben Davis does not class as a good eating apple or a good winter apple. It has the quality of being a good keeper and was planted throughout the country in large numbers, so that when the Ben Davis was ready for market there were probably millions of barrels of them ready to go on the market, and in that way the dealers were glad to handle them, because they knew that they had a start, that when they were dealing in Ben Davis apples they had a quantity to do business with all over the country.

Now in our State I think fully half as many varieties might be found to-day as will be found in the State of New York, and yet look at the short time we have been in the business. The result is that the apple buyer does not come to our country more than once, because he can't get a sufficient quantity of a particular variety.

Now our growers, to make a success financially of their orchards, will certainly have to come to three or four varieties of apples, and make an unwritten law and stick to it just the same as the people have in those countries where they have made a success of the business. Of course that is a serious question, but it does seem to me that after all these years, you might say twenty years, that this State has been experimenting along the line of growing apples, that we know all the varieties we have grown; that we are satisfied that this Society and the growers ought to be able to get together now and select out of them at least four of the very best varieties; they ought to be able to agree on four as being good, first-class apples, and the best that we can produce at this time and recommend the planting of those, and discourage the man who goes into the orchard business from planting anything else but those particular varieties for com-

mercial purposes. Allow him to plant and encourage him to plant all the trees and all the varieties for home use and for experiment, but he should never go into the planting of more than one or two of those trees. If he finds he has something very good, it is easy to change over a number of worthless trees he may happen to have to something that is good. But when he starts out with ten and twenty varieties, he has simply got a hopeless task to go and work that number of trees over, and his good years are spent waiting for nothing.

I know that at times we have discussed this question and we have selected some trees—I think we had agreed upon half a dozen varieties, but while that has simply been the vote of this Society that these six apples were the best, we have never yet gotten together a half dozen men in the State who would go to work and make those six or four, their only varieties. And I am satisfied, after careful observation of fruits in the market, and in the various sections of country that I have visited, that we will continue to have the conditions that we have just at present, so far as the possibilities of marketing our fruit are concerned, unless our growers will get together and select, out of the number they are now propagating, four or five varieties of the very best and grow only these. I wouldn't attempt to name which of those varieties should be selected at this time, but I would be glad whenever a committee was appointed to take up that question, to give them any information that I might possess. I believe that we have now in our possession some information from the work that was done during the last two years in regard to the storage of apples; I believe that our records will be of great value to the society or to a committee that might be appointed for that purpose in arriving at four apples that would make Montana famous. (Applause.)

SMALL FRUITS.

By T. T. Black, Whitehall, Montana.

I prepared a paper two years ago on the small fruit business that has been published and we have discussed the subject time and time again in the Farmers' Institutes, and I believe that we accomplished some good from the small fruit growers' point of view. I do know, that there has been considerable interest taken in the small fruit business since, in certain localities, that before seemed to have neglected it entirely. Now, I hardly know how to talk along this line, to men who are engaged in the small fruit business; it is well enough for me to talk to people who have had no experience, but with men who have had experience I can't see how we can discuss this question to be of much benefit. It is not necessary for me to tell these gentlemen who are raising small fruit how to raise small fruit, for they already know. There may be some subjects with regard to irrigation and the covering of the plants, etc., that we might gain a few points on by discussion and that would be worth something, but as to the necessity of small fruits and such things as that, I don't think it is necessary for us to discuss here.

I am not now so extensively engaged in the small fruit business as I was; I am not such a crank on it as I was two years ago, from the fact that I have got out of the business on the large scale. You who remember anything about the old system that I followed, will know that I simply put all of my time into small fruits and mostly on strawberries. It was a paying business, but I made a mistake or two and became a little discouraged along the line that I had mapped out, from the fact that after I raised the fruit I could not get it picked, and I lost thousands of dollars worth of fruit in one season because of that fact. That changed my plans entirely. It shows how foolish it is for a man to make a drive at something, and put his whole energies into it, and have the thing fail because he simply neglected to look out for one thing. I had no idea but that I could pick forty acres of strawberries in the State of Montana almost anywhere. But when I got twenty acres it was utterly impossible to pick them and thus I lost thousands of dollars in fruit in that season, and that discouraged me, and since that time I have let the business gradually go down. I am still of the opinion that there is nothing that a man can produce on the soil in the State of Montana

that will produce as much to the acre and with as little expenditure of energy and money as small fruits. Now, that is a big assertion to make in the presence of gentlemen who are displaying these beautiful apples, and it may seem incredible, but from all I have observed before and since the time that I handled the big berry patch, I am convinced that there is money to be made out of the business, if we keep within the bounds of what we can handle and handle right. Instead of having twenty acres of fruit of the kind you can't pick nor handle, why, have five acres, or what you can handle, and I still believe there are greater profits for the money and energy expended than in anything else we can do.

Of course, first, we must have a man adapted to the business, if you are going to make a business of it; we must like the business, and that is why I am more and more discouraged along this line than I have ever been before. It seems that in the rush of things here in Montana that people are looking for something bigger; it looks too small.

I had been unsuccessful with the Black Cap Raspberry. Up to two years ago, I could not get the crop that I thought I ought to produce. I changed the soil, and instead of taking a light soil, a dry soil, I took a heavy soil, and since that time I am satisfied in my own mind anyway, that I have struck the key-note to success. I believe that we can make fully as much, if not more, clear money from the Black Cap Raspberry as was ever made from the strawberry in this State. But with all of my experience with the Black Cap I could not get a paying crop on the soil that I had previously used; but after getting the plants on the heavy soil it simply produces enormously, and there is no crop that is surer than the raspberry crop handled in this way.

We cover our canes, of course, and avoid all danger of winter-killing and everything of that kind. I am satisfied now that there are many locations in Montana that are exactly adapted to the production of the raspberry. The raspberry blooms late. There is this difference between the raspberry and the strawberry,—the strawberry comes early; it is out in bloom just as soon almost as any plant can begin to grow; the result is that unless we can use some system to hold it back—and that is an expensive system of course, and even then it takes years of experience to know when to put the mulch on and when to take it

off, and if you make a mistake you have lost your crop, and your year's work. But the raspberry, it blooms so late that in fifteen years I have never had a raspberry bloom killed with frost, not one. It is an absolutely sure crop, as far as I have observed in our part of the country. The market is unlimited for this Black Cap raspberry. We sold at the rate of a dollar a gallon this year, and could not supply one-tenth of the orders, and I am not the only man who is raising raspberries; there were thousands of gallons raised in our community, and the market could not begin to be supplied. I am sure I am not exaggerating when I say that there were ten orders for every one that was filled.

Now, then, with an absolutely sure crop, it seems to me that the man who wants to engage in the small fruit business ought to plant some Black Cap Raspberries.

The Red Raspberry is also good, but I have been a little discouraged with it from the fact that we cannot market them extensively. I have marketed as high as an acre of raspberries that produced seven hundred dollars, but that was about the limit. We could not ship a Red Raspberry to Butte at all. We simply cannot compete with the raspberries that come from the west on the Butte market. But the Black Caps that come from the western market, many of them are spoiled, that is, they don't seem to get into that market in good condition; why it is, I do not know. But I had repeated orders from people in Butte with whom I was acquainted, saying that they could not get any Black Caps for canning purposes, and were willing to pay the price that we were getting from the local market. All of our berries this year were used right at home; there wasn't a Black Cap shipped to Butte, not one, from our community. Little towns like Pony, Whitehall, Twin Bridges would have used ten times as many as we had. So it seems to me that there is a market for this fruit. I am satisfied that on the right kind of land and rightly handled a man can make as much money off an acre with Black Caps, with less expenditure of energy, than he can off an acre of strawberries.

We have this advantage: we have never lost any fruit by frost with the Black Cap raspberry, while with the strawberry we have lost thousands and thousands of dollars' worth. I have seen fields of strawberries, not only my own but others, that were destroyed in one night, that were actually not worth picking, because of frost.

Another reason why the raspberry has a big advantage over the strawberry is in the matter of location. It seems to me that a man in this western country, in any place that I have been, would be foolish to plant a strawberry on a flat piece of ground. We can't even hold a berry back in our country long enough to insure it against frost unless we get it on a side-hill.

Question: North side?

It don't make much difference with us; I have tried it on all sides, and have certainly been in a place where I could test that. I believe the north hill side is the best, from the fact that when we do have breezes they come from the north and northwest, and of course if the side hill is exposed in that direction it has a tendency to keep the foliage or plant in motion, and it does not freeze where we can get a current of air. There are a few isolated places in canyons where that also holds good; a current of air will come up or down the canyon. But ordinarily I think it would be foolish for a man to set strawberries in any place except on a side hill if he wants to make money.

But in regard to the Black Caps, we had last year a heavy frost the latter part of May, but the plant was not advanced enough to injure one berry. I think I had as fine a crop of Black Caps this year as ever grew in any country for the amount of plants that we set, and it was one of the latest seasons for a hard freeze. Ordinarily frost that would kill a strawberry bloom completely would have no effect on a Black Cap. From the fact that they are up from the ground it seems to make a great difference. We had a frost once on the 19th of June that destroyed all the strawberries that were out in bloom; only a few were left; those were berries that were out early and the foliage was over the berries and they were protected,—berries half formed and beginning to turn to get ripe went through, but everything in bloom was killed. The raspberries of course at that time were almost in full bloom and not a bloom was killed. Now, whether that is the experience of others or not, I do not know, but I do know that in fifteen years we have had no raspberries, either red or black, killed by frost. The same is true with dewberries. While they are down on the ground, they come up so late, I don't know that I have had any dewberries in bloom at any time when we have a frost; in fact dewberries bloom very late.

Chairman W. B. Harlan: What variety of Black Caps do you use?

Mr. T. T. Black: So far I have used the Sohagon, the Kansas and the Gregg.

Question: Do they all have to be covered?

Mr. T. T. Black: Certainly; we don't worry about that, because we couldn't raise a berry without covering the canes; they would be all dead to the ground unless you covered them in our section of the country.

Question: How do you cover them?

Mr. T. T. Black: With dirt; simply lay them right down on the ground and cover them up completely with dirt.

Question: Spade or plow?

Mr. T. T. Black: I have used simply the spade or a shovel. We take three men; one man holds the plants down and two use the shovel, and it is not such slow work. Anyone would think it was a big job, but it is not. I had that figured out. I had canes that had been set two years, and they were large and met on both sides of the row, and if I remember right three men could cover an acre of berries in three days and a half; that would be about ten days and a half for one man for covering an acre of berries.

Mr. E. R. Kilburn: How long would it take to uncover the plants in the Spring?

Mr. T. T. Black: Simply to uncover them is a very small job; to get the dirt back, leveling the ground and mulching as they should be is not a big job; I think I could uncover the berries in a day with a fork. We simply take an ordinary manure fork and raise up the vines. There is a good deal of work in getting this dirt back. You see in piling this dirt on there you have a ridge, and it is necessary to get that back and level up the ground so that your irrigation can be easily done.

Question: Do you tie up your vines?

Mr. T. T. Black: No, sir, I have never tied any vines. When we go to cover the men bend them over to the ground, and a man with a sharp shovel cuts the tops off two and a half or three feet, depending on the case. It is an easy matter to raise them up, and they are already pruned, and it is a cheap way to do it. That is not the proper way to do; the proper way is to take the bud from the plant at a certain time when it is high enough to suit you, and let it branch. That is the proper system, and I believe I actually picked two gallons of berries off one bush that was treated that way last year.

Question: Could you bury that plant?

Mr. T. T. Black: Yes, sir, I could bury that plant.

Question: Do you have any trouble about their breaking off?

Mr. T. T. Black: Yes, sir, you have to be careful about that. Instead of bending the canes, bent it in the root; you might think it would hurt the plant but it does not. It is not necessary to break many canes, and as far as I have been handling them, where there are more canes than necessary, it wouldn't make any difference. But if you did prune them as they should be, and as I know they ought to be, you have to be careful about covering, because you have a strong plant, and if you undertake to bend them they might break.

Question: In bending down the roots, which side do you take?

Mr. T. T. Black: We bend the root right down over the place where we take the dirt from.

Question: You take the dirt back away from the roots?

Mr. T. T. Black: Yes, take the dirt away from the root, and we don't have any trouble; once in a while a cane will break, but if you are marketing fruit and have lots of them, what is a cane?

Question: About what does it cost to pick the berries?

Mr. T. T. Black: We paid a cent and a half a box and boarded the pickers, and they made good wages.

Question: Pint box?

Mr. T. T. Black: Yes.

Question: What does it cost for boxes and crates?

Mr. T. T. Black: This crate filled with boxes cost me twenty-four and a half ($24\frac{1}{2}$) cents, crate and all, and these boxes were made substantially; there is a rim around the box. They are made at New Albany, Indiana, and they cost $24\frac{1}{2}$ cents a crate ready to put the berries in. I call that cheap enough. You have a ventilated crate and the berries will keep, no danger of the bottoms falling out, everything ready to work, a child can handle them. With many others they are harder to get into the crate, while with the ones I am speaking about, when the crate is filled and the lid nailed on, everything is perfectly solid: they simply fit right up solid to the top of the crate.

Question: What has been your yield per acre of Black Caps?

Mr. T. T. Black: Well, I didn't have an acre of those good ones this year, so I could hardly say, but I am satisfied from the crop I had they would have made at least a thousand gallons.

Question: Did you find trouble in getting pickers of raspberries?

Mr. T. T. Black: We would if we had had a lot. You see I am not doing this on a large scale. I had in over half an acre of Black Caps. Next year I will have, if everything goes well, an acre and a half. Heretofore we have had great difficulty in getting plants of the Black Cap. In some way all the plants we have been able to get in our part of the country were defective in some way. Three years ago, when I first set the Black Caps I think I ordered three thousand, and out of the three thousand I have about 1,200 living. Of course that made me feel badly, but I happened to run across Mr. McClain and the next year I got my plants from him, and I don't think I lost half a dozen plants out of 2,500. And I would advise you, if you possibly can, to get plants in Montana by all means, even if you have to pay more for them. They are a tender plant. I don't understand it unless the people back east dig the plants and keep them over winter. The root of the Black Cap is almost as delicate as a strawberry, and we have never been able to get plants from the east that gave satisfaction.

Chairman W. B. Harlan: Hadn't they commenced to grow and the young growth is broken off?

Mr. T. T. Black? Well, very little, Mr. Harlan. I have had them when they looked very good, and when you took a knife those roots seemed to be dead and rotten.

Mr. C. H. Dallman: They are very easily over-heated in the boxes.

Mr. T. T. Black: Yes, probably that was the cause. So I would rather pay double the money for plants in Montana than to ship them from the east. I am not blowing up the Montana nurseries either as I have had some bad luck along that line too.

Mr. C. H. Campbell: In the matter of strawberries, have you ever tried the ever-bearing kind?

Mr. T. T. Black: Yes, sir; I got some from Mr. Dallman two years ago, and they are certainly a fine berry, and that year we had berries till frost. We set them out that Spring and they kept right on bearing.

Mr. C. H. Campbell: I had some in my office in Great Falls raised by Mr. Burlingame, gathered the 20th of October.

Mr. T. T. Black: I haven't been paying much attention to

them, I have been so busy, but I am satisfied they will be what he says they will be; if you handle them right and not let them dry up you will have berries right up to frost. Of course if you let them fruit right along and keep fruiting, there will not be many berries.

Question: How are you succeeding with blackberries?

Mr. T. T. Black: We haven't tried them to amount to anything. The dewberry is a money-maker with me. The plants I have now are wonderful; and there is no trouble to sell all we have at 20 cents a box, pint box, as fast as we can market them.

Question: What variety have you got?

Mr. T. T. Black: The Lucretia. It is what I ordered anyway; I don't know. Of course a man may get goods that are not true to name.

Question: Do you prune the dewberries?

Mr. T. T. Black: Yes, they should be pruned. Of course they make such a vigorous growth of vines that you have to prune them if you are going to be successful; that is, we don't let so many vines grow, but I let them grow in length and chop them off when we cover them. They are easily gathered, and I do not know any reason why they are not going to be a paying crop. My experience so far is that people go wild over them. They are delicious fruit, and many seem to think they surpass the Black Cap for canning purposes, though I cannot agree with them. Still, for eating fresh they are away ahead of the Black Cap. They are just as fine as the finest kind of blackberry; in fact I like the flavor better, I think, than any kind of blackberry I ever tasted.

Mr. T. T. Black: In talking about the question of prices for berries, I would like to say that, while Mr. Dallman knows what he does in his part of the country, we have raised in our community more berries than are raised in any other one place in Montana. We have never sold a berry for less than ten cents on the Butte market, and our express is now 50 cents a hundred; we have never sold a berry for less than ten cents that was in good shape, ten cents a box; and this last season, to illustrate, a man offered to contract for every berry I had at 12½ cents delivered on the cars at Whitehall. Now, where is the trouble? Missoula is only a little ways from Butte. A man in Butte actually wanted to contract for every berry I had at 12½ cents

delivered on the cars at Whitehall, and he would pay his own express. Where is the difference, I would like to know.

Chairman W. B. Harlan: Our expressage is just twice as high as yours, to start with.

Mr. T. T. Black: Yes, sir, that wouldn't be much though. When you talk about selling berries at 75 cents a crate, Mr. Dallman, were they in good shape?

Mr. C. H. Dallman: Very fine condition. They struck the market when it was glutted. They had berries from Utah and all over the country.

Mr. T. A. McClain: The advantage Mr. Black has, is that his season is later, and he comes in when all the other strawberries are gone.

Mr. T. T. Black: Your berries were on the market when I came in.

Mr. T. A. McClain: Just going off though.

Mr. T. T. Black: Yes, sir, ordinarily the most of my crop does come in after. But here, actually I have gone into Butte when your berries were selling four boxes for a quarter.

Mr. T. A. McClain: That was at the close of the season when our berries were small.

Mr. T. T. Black: No, sir, they were not so small. You shipped nice berries, but they were hot or something. But at the same time they would offer me \$3 for 24 boxes, or \$4 a crate for 32 boxes, and your berries were selling at retail for four for a quarter.

Mr. T. A. McClain: Our berries were going out; the latter part of the season.

Question: How long would you retard the growth of strawberries by mulching?

Mr. T. T. Black: The ordinary crop, that is uncovered about as early as we dare to uncover for fear of frost, we begin picking about the first of July, and then the late uncovering will probably start in about the 10th or 12th, ordinary season. Of course there is a difference of only ten or twelve days, but it is a whole lot.

Chairman W. B. Harlan: What do you mulch with?

Mr. T. T. Black: The best we can find is alfalfa hay to hold back; in fact, it is the only mulch that has been satisfactory to me to hold back; it is a little expensive, but it pays and pays big.

Twenty-five dollars an acre for mulching is nothing when you compare it with what you get out of that acre for the berries.

Chairman W. B. Harlan: Do you experience any difficulty in killing the plants?

Mr. T. T. Black: No, sir, I never killed a plant by mulching. But there is another thing we must all guard against, and that is not to cover the plants till they are frozen. I know a man who covered a couple of acres in order to go to California, and he did not want to go until his berries were covered, and started in to cover them up before the ground was frozen. I told him not to do it, but he covered them up with a good coat of manure, and in the Spring he didn't have a plant.

Chairman W. B. Harlan: How many tons of alfalfa does it take to cover an acre?

Mr. T. T. Black: Five or six tons will cover an acre of berries very nicely and hold them back better than anything else. I don't know why it is such a good non-conductor.

Mr. T. A. McClain: We have never had any success in the Valley with covering.

Mr. T. T. Black: Well, the conditions may be different there, of course. There is no use of my talking to you people about how to raise berries, because the conditions may be so different.

Mr. C. H. Campbell: That would make a pretty expensive mulch with us. Alfalfa is now worth \$13 a ton.

Mr. T. T. Black: Of course that would be unreasonable. We figure at about five dollars per ton.

Question: What we people want to know, is how the people in Oregon put the berries into the Butte market cheaper than we can?

Mr. T. T. Black: I can tell you exactly. Those people down there are satisfied with a small profit. We are not. I wouldn't raise an acre of berries of any kind that I didn't think was going to clear me \$250.

A Member: They certainly have the advantage in regard to cheap labor.

A Member: Yes, sir, and should be able to produce bigger crops; I don't know; I have never been there.

A Member: They can't produce bigger crops. They can ship their berries from Portland, Oregon, all those places, also from the Walla Walla country, into Butte just as cheap or cheaper

than you can from the Bitter Root, and just as cheap as Mr. Black can from Whitehall.

Question: Have you ever tried the blackberries, Mr. Black?

Mr. T. T. Black: No, sir, I haven't tried blackberries. The blackberry cane is very stiff. It is one of the hardest things to handle that there is in covering. I don't mean to say I have not tried any blackberries. I have raised them for my own use, but not for market. It is so hard to cover that you break off more canes than you can save, and when you dig up away from the root it doesn't seem to bend over like a raspberry; consequently I don't bother with them, because I can beat the price of a blackberry twenty-five per cent with that dewberry. I could buy blackberries in Butte this last year in the same sized box—and they were certainly fine; I don't believe there was a spoilt berry in a crate—for \$2.25 a crate, while I could have got for the dewberry at the same time 20 cents a box.

Mr. J. S. Good: In regard to the ever-bearing strawberry, my experience with them has covered a number of years, and I have had some success with it, and, as Mr. Black says, if properly handled they can be grown with very good success. I don't see much difference between them and the Wilson and other varieties; they produce about the same. After the first crop is gathered, we don't let them bear as long as they would ordinarily bear, but shut the water off and let them dry up, take a rest and cultivate them some. I would say that this year my crop was not as heavy as it should have been on account of digging out the buds. I let the plants go in order to get more runners. But if you let them dry up and rest a couple of weeks in the middle of the summer when the weather is warm, it is only a short time when you will have berries again.

In regard to help. We generally get girls and boys, and women sometimes, to pick berries, and just as Mr. Black says, once in a while you will get one to stay through the season, but as a rule they will stay two or three days and get two or three dollars, and that's about all they want. It would be impossible to employ men and pay them \$40 a month or \$2 and \$2.50 a day and compete with Utah and Washington berries.

Mr. T. T. Black: In regard to picking berries, I would say we don't pick berries over in our country as often as you do; we only pick berries once a week, and our pickers, girls, make

from \$2 to \$3 a day. It don't seem like wages has anything to do with it. I have had girls many times make \$3 a day.

Mr. Dallman: I would like to ask Mr. Black how he does his picking once a week; we have to pick ours three times a week or they would be rotten.

Mr. T. T. Black: It is the most remarkable thing to me; it is incomprehensible. I wouldn't want to have my berries picked more than once a week, and in that way we can get so many berries right at one time that the pickers can make big wages; for years and years I only paid a cent a box and they would make from a dollar and a half to two dollars a day. I have had girls who picked 225 boxes before noon, and had \$2.25 made and their board before noon. Of course the berries are thick, but in picking once a week the berries necessarily have to be thick. I shipped those berries down to Mandan and to Bismarck and further down into the Dakotas and even to St. Paul, and they claimed they came in, in good shape. I can't account for it. Of course there may be a reason. If I could go over and see the berry while growing I might know something about it.

TRUCK FARMING.

By H. C. B. Colvill, Missoula, Montana.

I am not quite sure what vegetables are included in the word "truck." In Missoula a "Truck Wagon" has to carry a complete line of vegetables and fruits or the customer will say, "I will wait until Jones comes around, and get my order all at once, thank you."

Raising everything and getting it on hand just when wanted takes some figuring and the wagon must take its daily trip or stand to lose its best customers. A short trial at selling bunched truck at wholesale rates, however, convinced me that I for one could not make a living at it; thanks, however, to a most excellently organized "Retail Merchants' Association," retail prices are always O. K.

There is, however, such an element of chance on green vegetables that the ordinary grocery store has to make a wide margin to come out even. Can we not, in spite of so many failures, organize some farmers' association, that with proper storage warehouses in our large markets, would systematize this market-

ing difficulty, and give the producer a larger share of the profits?

Soil in its virgin state will not, we find, give our five-acre farmers, returns large enough to live on. Most of us use manure which we figure costs us \$2 a cord by the time we get it home. So far from saving water, we find that the more manure in the ground, the more water is needed or crops will burn. This applies more to fresh manure than old. Old manure heaps in Montana's dry climate being generally dried up, worthless stuff. On this account some of my neighbors are trying nitrate of soda from San Francisco, which costs them, I believe, \$5 a 200-pound sack laid down.

None of us have gained enough on the manure hauling to try decomposing our own manure, although personally I have long had an empty manure pit ready for any I could spare, with a hose attachment fixed for wetting when necessary, and a puddled bottom to prevent seepage.

Last winter through mistaking the different kinds of bacteria in the manure, a very expensive fertilization resulted. I aimed of course to get bacteria which would work in the soil, but the goods delivered contained typhoid fever germs which worked every member of my family. Infected slops had, it seemed, been emptied on the manure heaps in the city, and the germs finding congenial environment, had multiplied exceedingly.

The cost per cord of the manure exceeded so greatly its fertilizing value that my winter's work was a dead loss to me. I am not as enthusiastic an advocate of the manure pile as I used to be.

Carrots have come to be quite a paying crop with us, as at the present price of bran, we find feeders very willing to give us \$8 per ton. In my case this brought me \$125 to the acre. My yield was not, however, as large as some of my neighbors. Can we find similar crops delivered straight from producers to customers, and paid for in cash as are feed carrots, most of us will drop our "truck wagons" and leave the field to the Chinamen, who are strenuous competitors in bunched vegetables.

Ripe tomatoes have been a paying crop this year, but are generally very risky.

The cucumber is another staple, as much home-made pickle is put up, ensuring a demand. Potatoes, early and late, is another safe first-hand crop. Everybody needs potatoes. Whether potatoes pay us or not, depends entirely on the yield, which

seems to be an unknown quantity. This year there were only one or two potatoes to a hill of a very large size. The year before a numerous set of rather smaller ones. Seed and treatment the same and all fields alike. The Missoula Nursery had the only good crop, which, owing to press of nursery work, were put in later than anyone else. I should like an explanation of this from the college experts. Could it be due to the bugs, which were more numerous than usual? I should like also an opinion as to the proper time to irrigate this crop. No two of us seem to agree on this subject, and results vary very greatly. In fact, it is a question, results are so uncertain, whether potatoes are a paying crop on our high-priced land. Twelve hundred sacks have been taken off six acres, where thirty sacks was an average per acre all around. Mine gave me forty sacks to the acre this year, which even at \$1.50 per hundred, which most of them brought, did not pay half as well, as carrots or cabbage, in vegetables, or any of the small fruits, the latter ranging from \$100 to \$200 to the acre. Of two men thus each depending on six acres for a living, one would have \$1,200 and the other \$180 only for his season's work, due perhaps only to a mistake in irrigating.

Now, this is no fancy example, we have such cases before us every day on these Missoula orchard homes, and perhaps the positions reversed the next year.

As to the rural economy of these small farms, ten acres is really the best unit, five in garden and fruit, and five in fodder and feed crops. Two or three cows, a horse, chickens and pigs could then be kept, which cannot be done on five acres. Five acres on the other hand is all one man can work, and no one can afford to pay \$2.50 a day for farm work and make anything.

My milk and butter bill last month came to \$7.50. For that sum I cannot, at present prices, afford to keep a cow, neither can I afford to feed \$1 a bushel wheat or \$1.50 vegetables to a pig. My horse ate last month half a ton of hay at \$7.50, besides carrots and grain. With the exception, therefore, of a few vegetables my living costs just as much as your townsman's. In my case about \$50 per month. The income so far has been chiefly from vegetables. I doubt myself if, on five acres, a man can compete successfully with the Chinaman on the one hand and the large grower with machinery on the other, in vegetables alone. Personally I am planting to large and small fruits as

fast as I can get my ground level. With more and cheaper land, however, the staple vegetables should yield good profits. The 160-acre farmer makes good enough money at \$25 an acre, where we must beat \$100 an acre to make our bread and butter.

A Member: Mr. Chairman, I would like to ask Mr. Dallman, in as much as reference is made to that potato crop, if his potatoes were planted with a potato planter or how, and for some information concerning them, if he will please tell us.

Mr. C. H. Dallman: I intended to speak of this particular potato crop of mine. In the first place, we were very busy with the nursery work until about the first of June, and when the work was done we found we had about three acres and a half of available land, and not knowing what to do with it we planted it to potatoes; that land had been previously planted with nursery trees. We plowed the land, harrowed it and smoothed it with a smoothing machine which we have of our own make so that it would irrigate nicely. After it was all smoothed very nicely we took a common ditch plow, with which we make irrigating ditches between the trees, and dropped our potatoes into the ditch made by the plow; we then took the same smoothing machine and covered them. That is the only secret of my potato success. I am not a very large potato grower, but on this occasion I had a very successful crop; we got 350 bushels an acre off three acres and a half, and I believe it was an exceptional yield because there were none others that came up to that amount. It may have been due to the fact that we use a machine for digging trees, and on this machine we work with six head of horses and dig underneath the trees about two feet and a half, thus cultivating the ground very deeply. And another reason for the large crop was that after the trees were taken off the year before, we put about a foot and a half of manure on the ground; very good, well-rotted manure, so as to give good fertilization for the next crop of trees, so I guess we had reason for having good success with the potatoes.

Question: You mean to say you put a foot and a half of manure on the ground?

Mr. C. H. Dallman: Just as thick as we could spread it, and plowed it under after it had rotted away and decayed to some extent. We had very hard work to plow it under, but with a good four-horse team you can plow very deep, especially with the soil as mellow as we had it after digging the trees. And

that is about the only thing I can say in regard to that potato patch.

Chairman W. B. Harlan: No great mystery attached to the fact that you got quite a large crop of potatoes from that ground.

Prof. F. B. Linfield: What time did you put the manure on the ground?

Mr. C. H. Dallman: Immediately after the trees were dug in the Spring. By the latter part of August it was decayed enough to plow it.

Prof. F. B. Linfield: And the crop put in the next year?

Mr. C. H. Dallman: The crop was put in the following year. I don't know that it was an extraordinary success. We had the ground in good condition, and we had a right to a good crop with the ground in that condition.

Prof. F. B. Linfield: On that potato question; T. B. Terry of Ohio swears by his potatoes. He only grows three crops: potatoes, wheat and clover, and he finds that the potatoes do best after the clover crop. He says, 'If I get a large crop of clover my soil will be rich, because the clover itself in growing enriches the soil.' Then the clover is a deep-rooted plant; it loosens up the sub-soil. By plowing in the Fall, the weather in the winter-time settles the soil and planting in the Spring, he gets a big crop. He find that with a minimum amount of manure and a minimum amount of cultivation he gets three large crops in three seasons.

Mr. T. B. Terry plows but once in three years as the digging of the potatoes in the Fall leaves the ground in excellent condition for the wheat crop so that it requires no further cultivation. The potato land sown to wheat is also seeded to clover completing the rotation.

Chairman W. B. Harlan: I believe there is a great deal in the necessity of using manure (especially if it is new) the year previous to trying to grow potatoes on the ground. I made an attempt at one time, and a failure, to grow a prize crop of potatoes. The Rural New Yorker, I think it was, offered a nice premium for the biggest crop grown with certain seed, and I thought I would try to get that prize. I hauled out manure a good deal like Mr. Dallman did in quantity and put it on top and planted my potatoes and did not get my seed back, while on the adjoining ground not manured I got a good crop. I think the next year I might have got good returns from that extra effort.

WHAT TO DO WITH THE UNSALABLE FRUIT.

By T. A. McClain, of Carlton, Montana.

I wasn't sure that I would be able to attend this meeting, and consequently did not make very much of a writeup. For that reason I think you will approve and appreciate it that much more. Now, as a preface to my paper, there was and is a very deep and grave question confronting us, as to what we should do with our waste fruit. We found that the larger the orchard, the more the accumulation was, perhaps because it did not have the thinning out and care that the smaller orchards had; and consequently we have on our hands not only hundreds, but thousands, of boxes of small fruit that is unmarketable. I took the matter up and made a trip east by way of investigation, looking into factories and gathering data and the result was that we established a vinegar factory in the Bitter Root Valley.

Perhaps the apple leads all the others as unsaleable fruit, and as the orchard becomes older, the smaller the apple, besides the windfalls. There was a time in Montana when any kind of an apple would sell but that time is past and now nothing but the choicest will pay to bother with.

I have experimented with these apples in manufacturing cider and vinegar with remarkable success, but am able to use only a small per cent of this class and unless there is a change for the better will not be able to use many more than I can raise in my own orchard.

Montana people generally care little for home products. Give them an article ever so good and still their old ideas prevail. The merchants seem to try to help build up home factories of this kind but their customers insist on something else and they have to get it. As an illustration a merchant in Butte was using about two barrels of my vinegar per week and pronounced it good vinegar but was compelled to ship in a car of another brand of cider vinegar because his customers would have nothing else. This merchant admitted that the Bitter Root vinegar was just as good as any other make and less in cost. That car alone would have used up 1,000 bushels of apples. This is only one instance in many.

It is not I but the fruit growers that should complain. Often too the merchant is at fault by wanting to make too much profit on a gallon of vinegar by insisting on a 100 grain vinegar, and this he dilutes to make three gallons. Customers do not stop

and ask what it costs and of what it was made, and usually do not care as long as they know that it is vinegar. Every gallon that comes into the state leaves about one bushel of apples on the ground to rot. A pure malt vinegar is just as good as a cider vinegar, but to get it pure is too expensive, especially if made 100 grain.

It was the apple that we started in to use up. We have fitted up a factory with the best and latest improved machinery to handle and convert the waste apples into something saleable. Our cider vinegar is free from adulteration except as to coloring, and that is made from something you have on your table every day—granulated sugar.

There are many uses that vinegar could be put to which would encourage the manufacture of it. One of which is pickles. From this alone thousands of dollars could be saved to Montana customers and growers of apples. There is no place that cucumbers grow better than in the Bitter Root Valley, or in the gardens and orchards adjacent to Missoula. This alone would make use of thousands of boxes of waste apples which would be made into vinegar, and while our good people are working for and looking forward to sugar beet factories they might give this a passing thought. There are many things, such as chow chow, catsup, etc., that would use a great deal of vinegar. But we will leave this subject and take up one of no less importance to the fruit grower. That of jelly, jam and apple butter. It should be made from our waste apples instead of that which is shipped into our state. The money has gone out and our apples are wasting. I have no statistics to show how much of this class of goods is shipped here but make a general estimate that there are no less than twenty cars (of 30,000 pounds each) of jellies, jams, etc., imported every year. This would mean 60,000 gallons, which would take 420,000 gallons of cider to make, or in other words, 14,000 bushels of apples. At the same time we are wasting on the ground more than enough apples to make this jelly.

Other uses of the apple could be by drying, which would be a great help in saving our waste apples besides keeping at home the money spent in importing dried fruit from outside.

The cider trade alone is worth looking after. Not less than thirteen cars are shipped into the state annually. This would, if made at home, consume 13,000 bushels of apples. Some say

that the Montana apple is no good for cider, but I say they are. Our crab apples and Wealthy apples I defy any country to beat. Besides nearly all the winter varieties are excellent and if properly handled make good cider. While we may never succeed in manufacturing cider for a beverage (as the cider drinkers are not here), large quantities of sweet cider are annually used for culinary purposes.

People are beginning to favor Montana cider and the future in that trade looks very promising.

It would not be fair to the fruit grower to close this paper without mentioning the plum and sour cherry. From the first planting to the present time seldom was an order given for fruit trees that plums, etc., were not included and when the plum year comes everybody has plums and no sale for them. The same may be said about the sour cherry. Tons of them go to waste. The cost to can this fruit is not very great so why cannot they be canned here.

Two years ago I fitted up a very crude affair and put up over 600 cans of plums. It was late in the season and most of the fruit had become too ripe or I should have put up more. There could be many dollars and cents saved by the fruit grower if a small cannery was built. A small cannery would can all that kind of fruit grown here, and in doing so, you would find plum raising more profitable than any other fruit grown in Montana. To invest capital to save small and waste fruits under the present conditions would only make a bad thing worse, and be building on a sandy foundation. As a remedy we must look to the legislature for a pure food law, a law that will exclude adulterated food stuffs that find a favored market in Montana.

Such a bill was introduced in our last legislature which passed the House of Representatives, but was turned down in the Senate where not even an amendment was offered, turned down as in the language of our senator from Missoula County, as a poor bill.

The fruit growers should bear in mind at our next general election and see that men that are favorable to the industries of Montana are sent to the legislature.

Chairman W. B. Harlan: I would like to ask Mr. McClain if he has found a market for the vinegar that he has made?

Mr. T. A. McClain: I would say we have; we have found a

very good market considering the time that we have been out soliciting. I find it is one thing to manufacture and another to sell, and it requires a man at both ends of the road. For the time we have been able to get out we have had very liberal sales, and we thank the people very much for what they have done, and the outlook is for a continued sale.

Chairman W. B. Harlan: I would suggest that we could open a market for such products much in the same way as they have throughout the eastern United States by what they call the "Apple Consumers' League." They organize and pledge themselves that when they go to a hotel for dinner, they will call for a baked apple, and they have increased the demand for apples wonderfully in that way. If the people of Montana, those who are interested in finding markets and procuring markets for home products would enquire for and ask for cider vinegar, pure cider vinegar, and Montana jellies, etc., made of fruit, they would create a demand for our goods in that way.

Mr. T. A. McClain: Mr. Chairman, I wish to say that I had an expert make a practical test of our cider, and he pronounced it first class for making into jellies, but, compared with prices of imported jelly, we find that our cider would be worth as much money or more than what jelly is ever sold for on the market. It is a jelly that is compounded and contains little or no fruit, and for that reason we are looking to the legislature for some relief. It will not only help me but every fruit grower in the Valley if we can get a pure food law enacted.

I will also say in regard to fruit, that we experimented in a small way in canning, put up something like 600 cans of plums, and there can be a very nice little profit on that. The machinery we used was very crude the work being done by hand. The heating apparatus was a vat that we lowered and raised by block and tackle, and was very inconvenient. But, instead of allowing plums and cherries to go begging on the markets, we should go to work and have them canned. The cans don't cost a great deal, and the sugar and those things that go into them, can be had right at home. I believe it stands every fruit-grower in hand to unite on some proposition of this kind. Now, as for myself, I have undertaken really more than any one man should have undertaken, being a farmer and not having abundant resources. In fact, I undertook too much, and I wouldn't attempt

to branch out on anything else; but I only offer this as a suggestion and in the way of advice, that these things can be done, and done at a profit. Instead of selling your plums for 25 or 30 cents a crate, and many tons of them are sold for less and tons of them remain on trees), they can be canned and put on the market and some little money made on them.

A Visitor: I have listened with much interest to Mr. McClain's talk on cider, jelly, etc., but one of the most important items I noticed he did not discuss. Now, I have been selling cider and apples and vinegar and jelly in Montana for the last fifteen years, and perhaps Mr. McClain does not know that it costs just as much to get a barrel of cider from Hamilton to Butte as it does from Chicago to Butte; just as much a gallon. You can buy pure grain cider in Chicago, made from grain, for one cent for each ten grains of vinegar. You can buy 100-grain vinegar in Chicago for ten cents a gallon; it costs eight cents a gallon in car-loads to get it to Butte; it costs eight cents a gallon to get it from Hamilton to Butte. If you can compete against that, with that freight rate, it will leave you just 10 cents a gallon for your product.

A Member: It costs three cents a gallon from McClain's (Corner) to Butte in car-load.

A Visitor: Locally it costs eight cents, because I shipped some and I know, unless the rate has been changed. How high a grained vinegar can you make?

Mr. T. A. McClain: Cider vinegar is 45. Did you ever see a cider barrel marked that wasn't 45? And when you get into malt vinegar it runs 95 or 100.

A Visitor: When you come to the market to sell vinegar and you go to the groceryman, you ought to get 30 to 35 cents to make any money.

Mr. T. A. McClain: Well, we are not getting that by any means. We are glad to get 25. I sold a car-load at 25 cents, 45-grain pure cider vinegar.

A Visitor: When you go to a wholesaler to sell him a car of vinegar, the first thing he says to you is, "I can buy a car of 90-grain vinegar, or 100-grain vinegar, in Chicago for ten cents. It costs me eight cents a gallon to get it here, and it is twice as strong as yours." You may say, "Mine is pure apple vinegar." He says, "What's the difference; mine goes just as well."

Mr. T. A. McClain: That is why we want the legislature to act, so the people will know. I will go a little further. You can't make 100-grain vinegar for ten cents. The evaporation, when you get above 70, is more than double what it was running up to 70. Now, do you know how that is made? Wood acetic acid is used to increase that to 90 or 100 grain.

And if you want to sell your customers wood acetic acid they should know it. That's what we are after. We don't want to prevent them selling vinegar, but we want you to mark on your barrel that you are selling your customers vinegar made from wood acetic acid.

A Visitor: I agree with you. There is nobody would be gladder to see all this acid vinegar shut out of Montana than I would, and see people almost forced to use vinegar made in Montana. But when you go to a groceryman and tell him, or to the buyer, "I will sell you a car of cider for 20 cents, pure apple cider vinegar, 45 grains," that man will say to you, "I can lay it down, 90-grain vinegar, for 18 or 19 cents." You say, "Yes, but mine is pure apple cider vinegar." He says, "What's the difference; no one ever kicks on vinegar."

Did you ever see a man take either of the vinegars and taste them and tell you which was which? The average consumer wouldn't know any difference. I am a salesman, and I know it is a hard proposition to run up against.

Mr. T. A. McClain: But you take ordinary dealer in vinegar, he can tell whether it is made out of rotten apples or out of something else.

A Visitor: And our interests are mutual. And it is not for the sake of argument that I am showing up the hard points. As a salesman I know what you are up against. Another thing about vinegar. The Daly ranch sent me over ten barrels of vinegar this Fall, and I sold it, and of the ten barrels I think six of them came back. Now, it was undoubtedly pure vinegar he sent me; Mr. Shannon told me it was absolutely pure, and I believed it.

Mr. T. A. McClain: I never had any come back, but I understand a merchant in Missoula had some come back; it was not strong enough; so there must have been a little water in it.

A Visitor: It was cloudy and was not filtered properly.

Mr. T. A. McClain: Under the ordinary process it is a hard

matter to get that removed, but under the generator process it removes all that sediment and it comes out free and clear of any sediment.

Chairman W. B. Harlan: If we could get a law passed during this legislature that would compel goods in Montana be sold for exactly what they are (don't try to keep out adulterated goods; you can't do it), but have them put a penalty on the retailer for selling goods without marking on them exactly what they contain.

Mr. T. A. McClain: And I hope they will go farther. If it be constitutional when a grower ships out any of his products let him mark on the package just what it contains, if it is a mixed box of apples, four, five or six tier apple, let it go on the box and show what it contains, and the consumer will know what he gets when he buys it.

A Visitor: About jelly. There are car-loads of jelly coming into Montana; they come in 30-pound buckets. Now have you any idea what a bucket is worth that will yield 30 pounds of jelly? I will be glad to sell anybody car loads at 32 cents a bucket; and that is the jelly which you get in almost all of the first class hotels in Montana.

Mr. T. A. McClain: It would take at least eight gallons of cider to make that gallon of jelly.

A Member: While in St. Joseph not long ago, I was in the National Manufacturing Company's plant there, and they were unloading a car-load of apple peelings, dried. I asked them what they were going to do with them. I think they told me they cost half a cent a pound, and that they were used in making jelly; they used two per cent apple peelings and the balance jelly.

Chairman W. B. Harlan: They couldn't afford to use many apple peelings at that rate without they adulterated them.

As I understand, there has been a bill introduced in the present legislature in regard to Pure Food, and I think it would be in the province of this body to adopt resolutions asking the passage of such a bill, not confining it to any one product, but to all.

A Visitor: The idea is a very good one, but the pure food bills that are generally introduced, in fact most of them that are laws in most of the states of the United States are practically of no use. The Pure Food Law of Minnesota is in my opinion the most perfect pure food law enacted in any State in the United

States. It says that goods must be sold for exactly what they are; any kind of adulterated goods can be sold and will be sold in any State, but if there is a law that puts a penalty on the retailer, if he is found selling any goods which are not marked just what they are, then he will take good care and buy his goods from responsible houses, so that he can come back on them when they sell him goods that are not what they are marked. I have seen many comments in all kinds of papers of the pure food law in Minnesota to the effect that it is the most perfect, and the best of any in the United States.

A Lady: I am a new-comer to Montana. I asked my grocer for pure cider vinegar. He said "I have Hennessy's Malt Vinegar, which is just as good; I am out of the cider vinegar." I thought the pure food laws were in effect in Montana, and I said, "Can't you tell me what steps to take to be sure I am getting pure vinegar for my jelly?" He said, "I have several kinds; I won't guarantee any one."

Chairman W. B. Harlan: I found on my pantry shelf a box which was brought from the grocer for cayenne pepper. I dusted some out. It was brown; I touched it to my tongue and I could scarcely discover any cayenne pepper taste to it. It was ground bark with just a suspicion of cayenne. Nearly all spices are adulterated the same way, as well as vinegar and jellies. Professor Traphagen of the Agricultural College a few years ago bought upon the open market about fifty specimens of jellies, and only found a very little fruit in any of them. Some a raspberry jam I believe—had timothy seed in them,—the raspberry seed probably came a little high and so he had put in timothy. And everything else is upon that same order.

A Lady: I don't dare buy vanilla unless I go to the drug store and buy the bean.

Mr. T. T. Black: I believe in the ranchers standing together, fruit-men and everybody else along these lines. Mr. McClain has cider to sell; we know it is pure; he guarantees it; there are other people who will guarantee it; and I believe, if the people who are interested along those lines in different parts of the State would make an effort, we would have a market for it. For instance, if I could get our merchants at Whitehall to talk the matter up with the people to demand some of Mr. McClain's vinegar, and he sold four or five barrels over there, it would help, wouldn't it?

A Visitor: I wish to congratulate you on the point you have just taken. There is the best advertising in the world. This gentleman says if everybody around Montana would insist on having some of Mr. McClain's Pure Cider Vinegar, and a merchant in Whitehall said he didn't have it; and he said "All right, I will send to Butte or Helena and get it," they would soon get your vinegar. One man asking for any particular brand or line of goods and insisting on having it, and if he don't get it from the man he is trading with, go and get it from somebody else is equal to a hundred or two hundred dollars' worth of newspaper advertising in Montana, and if everybody insists on having Montana vinegar, Mr. McClain would introduce it in a very short time, and you would receive more benefits from it than if you spent a thousand dollars in newspaper advertising.

HORTICULTURAL INSPECTION.

By Mr. R. A. Cooley, Professor of Zoology and Entomology,
Montana Agricultural College.

It is a striking fact and one often mentioned by entomologists and others that a large proportion of our more important insect pests are not native species but have been introduced from other lands. Some years ago Dr. L. O. Howard, Chief of the Bureau of Entomology of the United States Department of Agriculture drew up a list of the insect pests of prime importance to the people of the United States, rigidly excluding all species that were not strictly in this class. His list contained 73 species, the names of which are familiar to almost every farmer and fruit grower. Of these 73 species, he found that 37 had undoubtedly been introduced from foreign countries, 30 were native to the United States and 6 were of doubtful origin. A similar though somewhat superficial review of the most destructive insects operating in Montana has been made, bringing out the fact that fully one-half have been introduced either from other states of the Union or by way of other states. We have no evidence of the importation into Montana of any insect pests direct from outside of the United States, though such an occurrence is entirely possible.

Some of the introduced species have become a great burden to the people of the United States. The cotton boll weevil, intro-

duced from Mexico, caused damage amounting to about \$10,000.00 in 1902, \$15,000,000.00 in 1903, and at least \$22,000,000.00 in 1904, at which time it was operating through about thirty-two per cent of the total cotton acreage in the United States. Aside from this direct damage and the extensive amounts in the aggregate that have been expended by individual planters in the use of remedial measures, the Federal Government, during the last two years, has appropriated \$29,000.00 for defensive work. The State of Texas has also made small appropriations.

The gypsy moth, a well known European insect pest was brought in to America about the year 1869 and accidentally liberated in Medford, Massachusetts. It soon became acclimated and year by year became increasingly injurious as a pest of fruit and shade trees. By 1888 it had become notorious, in the country about, as a destroyer of vegetation. Not only did the caterpillars defoliate fruit and shade trees but garden and forest vegetation were taken as well and the moving masses of caterpillars and the great numbers of their bodies clinging to the sides of the houses and entering unscreened doors and windows, became a serious nuisance. In the warmer summer nights the odor arising from the masses of these caterpillars was sickening. In the worst infested regions people went out of doors as little as possible to avoid contact with the repulsive insects and in some places the value of real estate was materially reduced on their account. In 1890 the state commenced its defensive operations and during ten years on from that date expended from public funds approximately a million and a quarter of dollars. In 1900 and for four year succeeding, the legislature made no appropriations, the only effort for control during this period being made by separate towns and private parties. By 1904 the insects had increased so enormously that it was evident state aid was again necessary and the legislature of 1905 made an appropriation of 150,000 dollars per annum for aiding the towns in the work. Private citizens are expending about \$125,000.00 per year in protecting their property and the authorities of cities and towns are spending some \$75,000.00 on public streets and parks. Thus there is now being expended annually \$350,000.00 in controlling the gypsy moth in Massachusetts. The insect has aspread until it now infests fully four times the area occupied when state control was abandoned in 1899 and it has crossed the state's boundary into New Hampshire, Rhode Island and Connecticut.

Scarcely less in importance is the brown tail moth. This insect has been in America for a much shorter period than the gypsy moth but having spread with much greater rapidity, is now scattered throughout a much wider area than is the gypsy moth. Beside injuriously affecting a very large number of plants, particularly fruit trees, this species is very objectionable on account of the excessive irritation caused when the hairs of the caterpillars are brought in contact with the tender skin of the human body. These hairs are loosely attached to the body of the caterpillar and may be blown for considerable distances falling upon persons underneath the trees or in the vicinity. The irritation may be induced even by wearing articles of clothing that in drying in the laundry yard have caught the hairs that were blowing through the air. This species is now spreading very fast and has appeared in some of the satte surrouding Massachusetts. It is a special particularly liable to be distributed by careless nurserymen.

The notorious San Jose scale first made its appearance in the United States in the town in California whose name the insect now bears, about the year 1879. In very recent years it has become known that the original home of this insect is a remote region in China. Mr. C. L. Marlatt, of the United States Department of Agriculture, who made very careful investigations into the original geographic location of this species, visiting China and Japan for the purpose, states that he believes the species was introduced into America on ornamental plants. Beginning at San Jose, California this insect has gradually spread until it now occurs practically throughout the whole United States though we are glad to say that it has not yet been found in Montana. Because of its small size and decidedly inconspicuous appearance it has been readily distributed on nursery stock and is a striking example of the facility with which an unrecognized species may be innocently distributed in connection with legitimate business practices. It would be very difficult to estimate with approximate accuracy what this insect has cost the people of the United States. There are few if any species in this country, or in the world, that are capable of inflicting greater damage than this very small but very prolific scale insect. It feeds on a very long list of plants but is particularly injurious to fruit and shade trees and woody ornamental plants. Trees and

shrubs to enormous values have been destroyed and large sums of money have been expended in the application of remedies. Nurserymen have been under great expense in attempting to keep it out of their nurseries and have succeeded to a great degree. Many of the Experiment Stations have expended liberal sums in attempting to improve the remedies. Moreover, large sums of money in the aggregate have been expended by state legislatures in the enforcement of regulation aimed to prevent the introduction and spread of the insect. Nearly every state in the Union now has laws on the subject.

These insects and many others have been brought to our shores in one way and another and their presence constitutes a problem of no small moment to the people of the United States. Not only are the producers of vegetable and animal products affected but all classes as well for in cases of loss of crops by insects the public suffers with the tiller of the toil through paying an increased price for produce. More and more the problem of controlling all such insect pests is engaging the interest of all persons who have the public welfare at heart and more and more individuals are forced to act in their own defence. It is well that all should be interested for it takes but a glance at the course of events in these matters to see that there is need for greater and more concerted effort in the control of insect pests. From what has been said and what follows it is plain that there is increasingly a tendency toward the world wide distribution of every insect pest of every country that has commercial or other relationship with lands across its own borders. In other words, there is reason to fear that we shall eventually have in the United States a very large number or even all of the insect pests of this and other continents. I have no desire to arouse unnecessary anxiety but with the marvelous development in the agricultural and horticultural science and the great progress that is being made in the introduction of plants of value from other lands and having in mind at the same time the great power shown by many insects to adapt themselves to the conditions of new localities, it seems that a note of warning is timely. True, many of these species which may be introduced might not be very injurious in the present generation but as we now reap the magnificent benefits which have come to us through hardship of our forefathers and the pioneers of this land we owe to following generations

that the heritage shall be handed down not impaired, but increased.

It will be interesting at this point to analyze the ways by which insects are disseminated and in order to understand how insects find their way over great distances through the oversight of man, it will be necessary to first briefly outline the habits of insects in general.

The majority of insects that are liable to be introduced have four distinct stages in life, namely; egg, larva, pupa, and adult. Among individual families, genera and species there is the greatest variation with regard to the habits of insects in the various stages. The eggs may be laid singly on a large number of plants or in the soil or they may be laid in masses. They may be laid with the greatest degree of care for the good of the young or with striking carelessness. The eggs may be laid very soon after reaching the adult stage or only after a period of hibernation or aestivation. The eggs may hatch after a very brief period of incubation or only after a long resting stage and subsequent incubation. The larva is the second stage in the life of an insect. The larva hatches from the egg and it is in this stage that all true growth occurs. The larva may begin its feeding in one season, hibernate in a partly grown condition and complete its growth during the next year. As a rule, however, the growth of the caterpillar is consecutive and in all cases ends in the transformation into a pupa. Perhaps the majority of insects pass the winter as a pupa though there are many species which may pass the winter in a number of the different stages of life. Thus, the strawberry crown girdler hibernates as an adult, a pupa and a larva and perhaps also as an egg. In preparing for pupation, insects generally seclude themselves in a cocoon, a cell in the earth, or in some other manner but generally surrounded by a protective covering in such a manner as to protect them against their numerous enemies and unfavorable climate. The adult insect does not grow, is usually equipped with wings, and is charged with the responsibilities of laying eggs for the perpetuation of the species. Many adult insects hibernate and in doing so, withdraw into all manner of secluded spots. Many go into the earth, many crawl under bark or in hollow trees or under any kind of rubbish on the ground and a large number of species enter houses or outbuildings in their vicinity. Some species con-

gregate in a common hibernating place while many hibernate individually.

A few insects, comparatively speaking, in place of having four stages of life, have three known as the egg, nymph and adult, in which case the nymph stage covers the life between the egg and adult condition. There is no quiescent period. In such insects, hibernation may occur in the nymph stage but the winter is more commonly passed as an adult or as an egg. Most grasshoppers pass the winter in the egg stage, and many bugs in the adult stage and in these two orders are included a large number of the insects which are more liable to become injurious pests in any country. Scale insects are bugs and among these there is a wide variation as to the manner of passing the winter.

It will be seen that in these various stages of life many species are liable to be introduced into new countries on plants or parts of plants or among seeds that are bought and sold. They may be attached as eggs or pupae to any part of the tree or plant or in the earth about the roots or as adults they may be clinging to the trees and be wrapped up in the packages or they may for hibernation purposes enter any packing material used in shipping trees or any other articles resting near their breeding quarters.

There are two great classes of agencies or ways by which insects are disseminated, namely; artificial and natural. Man is responsible for the artificial dissemination of insects. Incidentally in his various pursuits he affords facilities for the world wide distribution of any species that feed upon any of his cultivated plants, enter his house, or crawl into his merchandise or into the boxes or material in which merchandise or other movable articles are packed, or that in any other way come in contact with his home or his business. Nor is this all, for in the moving of armies and their equipment and supplies and in the assembling and later redistribution of articles brought together for state, national or international exhibitions, and all similar operations that involve the moving of articles from one point to another, opportunity is unwittingly afforded for the dissemination of insects.

In importance overshadowing all other means are those afforded by the commercial practices of the American and other people. We are living in a stage of remarkable activity in the exchange of merchandise between countries. The people of one

country trade with those of many countries and the sum total of values exchanged in this way is enormous. The merchant vessels from the United States are constantly plying back and forth over the pathless waves between our shores and those of almost every other country on the face of the globe and from many foreign points come countless vessels sailing under the flags of other nations. In the mind's eye we can see the vast expanse of waves dotted here and there with many costly vessels whose home ports are thousands of miles away. By modern means of rapid communication we are kept in touch with the needs and prices in foreign lands and by cablegram or wireless message the vessel's owner may follow and direct his business in foreign waters.

From summaries published by the Bureau of Commerce and Labor at Washington it is apparent that the commercial dealings of the United States alone during the present year (1905-1906) will amount to not less than three billions of dollars which may be divided into imports \$1,225,000,000.00 and exports \$1,786,000,000.00. These figures exceed those of any prior years by \$100,000,000.00 for imports and \$200,000,000.00 for exports which indicates the rapidity of growth in these interests.

By these artificial means, insects may be and are being extensively distributed to all quarters of the globe and the extent of our dealings with other countries indicates the great number of opportunities afforded insects to enter the United States. By these artificial means, insects are carried over great distances as from one nation to another but they must rely upon their own effort principally for general diffusion from the points where they first land and colonize. These first colonies may be near the sea border or just across international boundaries or they may be far inland. Such first colonies are usually to be found in or near large settlements. The smaller outlying towns often receive such colonies yet more frequently indirectly by way of larger towns. From these towns by natural migration or in connection with commercial practices or any of the daily activities of men or even on the feet of birds or on the bodies of other animals or floating on streams or water, the insects gradually are diffused through the surrounding country, each minor colony as it is formed being a new center of general distribution.

We have already indicated that in the adult stage most kinds

of insects can either fly or walk and that in their migrations in search of food for breeding purposes or in following out any other natural impulse, they cover greater or less distances. In obedience to the laws of nature they extend themselves until limited by natural barriers, such as mountain ranges and climatic conditions unfavorable for their lives. Thus in the bright hours of the day we may see butterflies, beetles, bugs, bees, ants, wasps, flies, and all manner of insect life in constant motion in the air and on the surface of the ground. While in flight insects are often blown over great distances. It is not improbable that some species instinctively take advantage of air currents to aid them in their passage to new localities. The brown tail moth in Massachusetts is a striking example of the influence of wind on the extent and direction of diffusion of a winged insect. Following the direction of the prevailing winds this species has spread very rapidly from the point near Boston where it was first introduced. Though it arrived in this country very much later than the gypsy moth, it now covers a greater area and the indications are that it will rapidly spread by natural means from the New England states westward. While natural agencies are at work artificial agencies still have opportunity to distribute this or any other species over great distances. Let us suppose a case. I was born and brought up in New England. On my father's place is a variety of pears I particularly desire to have started on my property in Montana. I have a friend send me a few trees from the old place which have been started from cutting or scions from the old stock. The trees arrive in a small express package and are set out in my back yard. A small cluster of dead leaves on the branches on one of the trees escapes my notice and as the trees put forth their leaves in the spring the minute caterpillars issue from their nests within the leaves and feed upon the leaves. Later I find that my apple trees, rose bushes, and other trees and shrubs are affected by a not unusual looking caterpillar. On investigating the matter I find that the caterpillars are the dreaded brown tail moth. So far as we know this has not so far occurred in Montana but this or a similar incident may occur at any time or would occur but for our horticultural inspection.

In their natural migrations species are usually distributed along river courses and lines of travel and do not often cross

mountain chains though they may cross broad rivers. The fundamental principles underlying insect's migration are imperfectly understood yet it is apparent that certain principles are at work governing these migrations. We have observed that the common salmon fly as it emerges in the month of July along river courses in Montana, mounts high in the air and flies up stream, settling at some point far above where they emerged and develop their wings. Here they breed and in our rapid mountain streams are doubtlessly washed down stream again. Thus these insects instinctively counteract the influence which tends to bear them as a whole race toward the mouth of the stream. Again we may observe on almost any bright day the common thistle butterfly, *Pyrameis cardui*, flying constantly in one general direction. I have in the vicinity of Bozeman seen countless numbers of this species all flying toward the east. They were not in swarms but all impelled by a common instinct, they seemed to be following inevitably some hidden law. Similar phenomena may be observed in our mountain valleys with other species.

I know of no more striking example of the extensive distribution of a species through a combination of artificial and natural means than that shown by the strawberry crown girdler, *Otiorhynchus ovatus*. This species has no wings and can no more fly than an earth worm and can crawl not much faster than the earth worm, yet it occurs all through Montana and is generally distributed in northern United States from the Atlantic to the Pacific. It is known to occur in Europe and it is probable that the original home of this insect is the northern portion of the European-Asiatic continent. It is the habit of this beetle, in the adult condition to crawl into houses and other buildings to hibernate and it is very probable that this species was introduced into the United States by being transferred undetected in some shipment of household articles or in plants. It was first detected in this country about the year 1852 and in slightly more than fifty years it has established itself all through the territory that it is capable of occupying in spite of the fact that it cannot fly and is dependent upon other means for distribution except over such distances as it can cover by crawling.

Of these two great classes of agencies, that work in the diffusion of insects, it should be stated that the former or artificial is largely responsible for the introduction of the numerous in-

jurious species. As has been pointed out by Prof. F. M. Webster of Ohio we have in the past received many exotic species through natural migration along fairly definite courses which he has indicated. It is noticeable that the northern parts of Europe, Asia and America have in common many identical or very closely related, species and it is believed that these were in former times diffused by migration across a land connection between the northern part of Asia and this continent which geologists tell us once existed. It is believed further that the diffusion was from Asia into America rather than the reverse.

Many species have come to us from Central America and even from South America. Prof. Webster has pointed out that many species have made their way into Florida and the United States by way of the West Indies. Through the ages these migrations have been a mighty factor in the diffusion of insects and have had much to do with the make-up of the faunae of the different regions of the world but in these days in connection with horticultural inspection, farmers nurseymen and the general public are particularly interested in the part that commerce and the other accompaniments of civilization play in the spread of injurious species. The great bulk of such species now in America that have reached as in connection with commercial practices have come from Europe, but with our present interests in the Philippine Islands and considering our increasing commercial interests in that quarter of the globe, there is a growing danger from introductions from oriental and Australian faunae.

We have discussed the injuriousness of the San Jose scale and while this species is responsible for great losses, it has at the same time been a source of great benefit to the people of the United States in arousing interest in suitable legislation aimed to restrict the dissemination of injurious species. The benefits from this species and the injuries while not similar in kind might almost be said to offset each other. Had there been no San Jose scale and no laws aimed to control it, we would be some fifteen or twenty years lacking in valuable experience in this important matter. While these laws which were erected in the various states, we might say almost simultaneously throughout the country, were intended first to control the San Jose scale they were framed on such broad lines that they were applicable to other injurious species as well. Without the San Jose scale

menacing our orchards, and ornamental plants, these laws would not have been erected in most of the states. They were enacted to meet an emergency and while they were prepared with due deliberation, in the absence of previous experience their specifications were not perfect. Beyond a question an enormous good has been done by these laws not only in restricting the dissemination of the San Jose scale, and incidentally other injurious species, but also in gradually shaping public opinion toward a point where more comprehensive and rigid laws may be passed.

At this point it is desirable to discuss in a general way the horticultural inspection laws of the country and their enforcement. In attempting to control the spread of foreign species through legislation, two points are fundamental, namely; the enactment of wise laws and the proper enforcement of these laws. With the growing need for such legislative control as indicated by what has been said, it seems apparent that a greater measure of efficiency should be secured both in the laws in their enforcement. The attention of legislators has been secured to such an extent that it now seems possible to secure the passage of laws that a few years ago would have seemed too exacting and too expensive. The agricultural welfare is the groundwork of the welfare of the nation and since insect pests have taken such a prominent place in modern aggressive and scientific agriculture, the people of the United States either separately as states or unitely as a nation should use every reasonable effort to restrict them. Laws that have been enacted in the past have dealt principally with the insects injurious to fruits only. We should not wait until very injurious species have established themselves in our general agricultural crops to an overwhelming extent before we make our laws broad enough to cover all cases but should so change the statutes as to prevent as far as possible insects of any character from coming without hindrance. Those who have given these matters most attention appreciate very well that the laws however well prepared and enforced are not an absolute barrier. The San Jose scale laws have not absolutely prevented the further dissemination of this pest nor have the horticultural laws of Montana entirely prevented the codling moth from coming into our orchards, yet each law operating in its own territory has done a great good in reducing to a minimum the chances of infection and in calling the attention of fruit growers to the importance of heeding these matters.

At the last annual meeting of the American Association of Economic Entomologists held at New Orleans last December the national control of these insect pests was prominently discussed. A committee was elected to consider this matter and report at the succeeding annual meeting. This committee, through a circular letter, has indicated that it finds a sentiment favorable to the national control of introduced pests. Just how this may be brought about with so many laws already existing on the statute books of the various states is not clear but that there is need of national control at least of some features of the problems is apparent. The cotton boll weevil in Texas and the gypsy and brown tail moths in Massachusetts have practically demonstrated themselves to be beyond the control of the states in which they are found. The state of New Hampshire for example is infected with the gypsy moth which has come across the boundary from Massachusetts. Thus though New Hampshire may have a very restricted area that is infested since her jurisdiction ceases at the boundary of the state she cannot prevent reinfection. In this instance the state which is the source of infection has made an almost heroic fight in defence of her vegetation and her good name. Clearly such a matter as this should come under federal, rather than state jurisdiction. Again, in the matter of governing the precise manner in which nursery stock shall be transported since interstate commerce is affected, it would seem that the federal government should at least have a supervisory power and secure uniformity of requirements in different states of identical interests. Some have thought that the same desirable result of uniformity can be secured by the various states harmoniously agreeing to the specifications in their various laws which affect parties outside of their boundaries. What the outcome of this agitation will be is not clear but it seems desirable that our horticultural and agricultural public should take an active interest in these matters.

In other minor details improvements might be made in the various laws. However, we believe that for the present there is greater need for the rigid enforcement of such specifications in our laws as are good. At this point it seems desirable to discuss what should be the relationship between state horticultural officials and Experiment Stations. To the writer one point is clear. The first duty of the Station Entomologist is to acquire such in-

formation regarding insect pests and their control as will enable those in need of relief to successfully combat species on their premises. To do this requires first a broad knowledge of the insect fauna of the state, the native or wild food plants of the various species that are or may become injurious, the habits of indigenous and introduced species, the limit of strength of insecticides that the various economic plants will stand, etc., or in short, all those problems which in their solution require the use of expensive libraries and the services of a person who has made his life work the solution of such special problems. In order that such an official may properly connect his scientific researches with the needs of his state it is necessary that he should spend much of his time in the field and in contact with the persons who are in immediate need of his services. In performing the duties of this class the station entomologist finds a full duty. Equally well defined is the duty of the state inspector, and the two duties should not be combined in one person except in unusual cases. The primary duty of the inspector as our present inspection laws are framed is to watch for new importations and stamp them out when possible. It seems probable that under most circumstances when a species gets beyond the control of the official inspector he should turn his attention more particularly to watching for new arrivals. Thus he should stand at the gateway of the state and so far as possible prevent the entrance of species that would do harm to the state's interest. He is not an experimenter primarily or a student of the life history of pests though he would be able at times to perform valuable experiments and make valuable observations. Such experiments and observations, however, would be of a fragmentary nature. In the discharge of his duties a fair business ability is demanded and a knowledge of men and affairs, but we should lay down as a primary qualification of an ideal inspector a good working knowledge of the classification and habits of insects. In other words, he is a practical entomologist rather than a technical one though in the proper discharge of his duties a considerable amount of technical education is required. The station entomologist and the state inspector can be of great service one to the other and hence of more service to the state by co-operating one with the other. The inspector should always be at liberty to call on the station for information and the entomologist at the

experiment station should have frequent conferences with the inspector in regard to the vital problems affecting the people at large. Horticultural inspection is an American innovation as is also the system of official entomologists established in the United States. The two institutions have been growing up side by side and gradually men have been equipped to occupy these positions demanding these new qualifications. The duties of the station entomologist and the inspector as here outlined, express an ideal condition rather than an existing one. One of the primary duties of our agricultural colleges is to equip men to take such positions. We are gradually passing the point where it is necessary to employ inspectors who have not had the advantages of such a training. In fact we have already arrived at the time when in some states at least it is more difficult to get the necessary funds to employ suitably equipped men than to find the men. In this connection we should state what appears to be an obvious truth, namely, that a system of inspection in a state requiring separate inspectors in separate districts is the suitable system only in the states where in the separate districts there are sufficient interests at stake to warrant the appointment of men who have suitable training and hence who demand a considerable compensation. We believe that some mistakes have been made in this direction. Plainly in some states where a number of poorly paid men of insufficient training in entomology are discharging the duties of inspector in connection with other duties which furnish their main income, these men being responsible in various districts or counties, it would be much better to assemble all sums thus apportioned to the districts and thus make up a suitable compensation for a well trained man who could employ a few well chosen deputies. This corps of workers or most of them could be employed throughout the year. They would or should be state's men with the interests of the whole state at heart and not influenced by any local interests or prejudices. There may be a few states which have in the various districts or counties such enormous interests at stake and which are backed up by large state appropriations that require and can afford well trained and well paid inspectors in the various districts or counties. The enactment of uniform specifications in the various states regarding the certification and transportation of nursery stock and other infected goods would enable us to maintain in each state a

smaller force of deputies. For example, with the chief inspector in Montana residing in Helena and a few deputies notified ahead of the expected arrival of goods at this or that point, if the certificates of all the states shipping stock and suspected goods into Montana were accepted in Montana, equally good results might be secured with an equal or less expense and with much greater facility, provided that in each state issuing such certificate the horticultural inspectors are well equipped and discharge their duties with care and fearlessness. It should be possible in all cases for one state to accept the certificate issued by another state's official and a purchaser of nursery stock should not be forced to purchase trees from inside his state to avoid dangers to the vitality of this stock through its being opened up in transit and repacked, often under conditions which make it difficult to keep the trees in good condition.

In the foregoing paragraphs, we have attempted to call attention to the needs for systematic guarding against the introduction of destructive insect pests and the methods by which their diffusion may be retarded. While in all that has been said the conditions and needs in Montana have been held in mind the subject has been discussed from a broader standpoint for we feel that only by considering the needs and conditions in other states as well as our own can we arrive at the safe conclusions for our own state. We have dealt with generalities rather than specific cases and it is desired that the fruit growers and other agricultural people and the horticultural and agricultural societies of Montana through the individual members and through the official programs, should give to this important question the attention it so evidently needs.

LIVE STOCK.

THE FUTURE OF THE SHEEP INDUSTRY.

By Hon. E. O. Selway, of Dillon, Montana.

Having been in the sheep business only a few years, it appears to me I am usurping the privilege of others in trying to tell you anything about it. However, I will square myself on the start by saying that what I don't know, if written by some one else, would make very interesting reading for one who wishes to learn the business. I think the man who carried on his business from 1892 to 1896 and got out with some sheep, is the one who should talk to you of the sheep industry and its future. We who have started since that time, are lacking information which would be essential should like conditions prevail. I was invited, however, to give you my views on the subject and you can take them for what they are worth.

Beaverhead county is the banner mutton-producing county of the state, and, taking into consideration the fact that comparatively few of our sheep, until very lately, have found their way to the Eastern markets, we have, I think, established an enviable reputation for our product. The past season, our surplus sheep were disposed of before the trading was fairly started in most localities, which seems to me conclusive evidence that our sheepmen have their business well in hand and will probably not get much information out of what I have to say.

The successful sheep business, in my opinion, is dependent upon the ability or good luck in getting a class of sheep suited to the peculiar conditions under which we anticipate handling them. Probably no two of us are following exactly the same line of breeding and yet each is satisfied with the result obtained. So long as something is produced which looks good we are disposed to say it is the best that could be done under the circumstances and proceed to make the most of it.

If you propose selling your wethers at two years old, it is unnecessary to breed for lambs which are first class mutton at four months old—in fact, the sheep which will shear heavy fleece is

more profitable to hold over—but should you wish to sell the lamb for a large price, the wool, it seems to me, must be disregarded.

We have, in this locality, room for both kinds. Our soft mountain feed will produce as good mutton lamb as is produced anywhere; while the dryer range will grow a profitable sheep to hold over, and there is a good demand right here for all matured wethers we have, and plenty of hay to fatten them on. I would say to the man who intends starting into the business: Decide at what age you want to market your stuff and breed accordingly.

I started in the sheep business with the idea that selling my lambs was the profitable thing to do, and bred for that purpose. The prices I obtained at first were satisfactory, then there came a drop for two years and I held the lambs of those years. When I sold my wethers I found they had not brought me any profit to speak of. They had not shorn enough wool to make them profitable because they were not bred for wool. This year I sold those ewes for a satisfactory price but they have shorn two pounds less wool each year for four or five years, than they should have done. I had better sold those sheep as lambs and put the money into good wooled sheep.

The most profitable combination for me to handle is the smooth, heavy-wooled ewe crossed with the best mutton-bred sire I can procure. I do not say what breed in either instance, because any of them are all right, provided the sheep are good. The lambs produced from this cross, I think, should be sold as lambs each year. Lambs of this kind bring more in proportion to the cost of production than at any other age. The man who produces the ewe I describe, I think, will always have a local market for her. His wethers he will have to keep till maturity, but his experience should not be the same as mine for he will get about three pounds of wool per head more than I did.

The day for haphazard sheep-breeding is past. We must, it seems to me, raise sheep for a special purpose. I think it impossible to produce an early maturing lamb and at the same time get him to shear enough wool to pay to keep him over. I don't know what our wool or mutton will be worth next season, say nothing of further into the future, consequently would not pretend to say which to breed for. Personally, I would let my local range conditions govern my choice, for I think good sheep of either kind will always be profitable.

WHAT AGRICULTURAL DEVELOPMENT MEANS FOR THE LIVE STOCK INTERESTS.

By F. B. Linfield, Agricultural College, Bozeman.

Montana is a great stock state; she always will be. In the past the range has fed the greater portion of the stock; in the future the farmer is going to feed a very much larger portion of that stock. As I travel over the state, I find that in some districts already the people are asking, "What are we going to do with our fodder crops?" And I think, as has been stated here before during this meeting the farmers of the state cannot afford to farm, if they wish to get the largest returns from their farms without growing alfalfa and clover and such class of crops. They have got to grow these crops if they expect to maintain the fertility of their soil and reap the largest returns from their land. The question is coming—I say it already has come in some places—"What are we going to do with this large fodder crop?" The answer to that question is: "We are going to feed it; we are going to turn it into livestock products," And I believe that right there is a profitable opening and a profitable line of industry upon the farms of the state.

I was recently looking over and figuring out the number of livestock, found in Montana, and I find it in round numbers, to be about 7,000,000 head, counting cattle, horses, sheep and hogs, on the ranges and on the farms of Montana. There is in the state about 93,000,000 acres of land, including the mountain ranges, and about 68,000,000 acres of this is grazing and farming lands according to the United States reports. This would mean that we have one head of livestock, cattle, sheep and hogs, on every 15 acres in the state, if we include the whole state. We have one head of livestock on 10 acres of what is classed as farming and grazing lands in this state.

Now, that does not seem to be a very thick livestock population. Comparing this with some of the states in the east, we find that Iowa, on the same basis of calculation, has 14,000,000 head of livestock. That would mean, on 36,000,000 acres of land, two and one-half acres for every head of livestock that they have in that state. You can readily see that Iowa, taking the whole state into consideration, has six times the livestock population of Montana in proportion to the area of land. Kansas, where we

have a state which, in part, belongs to the humid and part to the semi-arid belt, has 6,000,000 head of livestock; and it was not a great many years ago that Kansas was considered to be nothing more than a grazing country. This means on 52,000,000 acres, that they have one head of livestock to nine acres of land. Illinois has 8,000,000 head of livestock on 36,000,000 acres of land. This would mean that they have one head of livestock for every four and one-half acres of the area of the state.

You can readily see that, while Montana is a great livestock state, we are a long way behind some of these other states in the east, of not much more than one-third of our area.

I have had some little opportunity of comparing the crop returns under irrigation with the returns in the humid region of the east, and, taking a like temperate region, I believe it is possible to grow upon the Montana irrigated farm as much on one acre of land as it is possible to grow on two acres of land in the humid district. When it comes to pasturing stock, I believe the difference is even greater than that. I have pastured two head of cattle on one acre of land for three and one-half months. In the station reports of Professor Shaw, he pastured four head of cattle, 2-year-old steers, on one acre of land for three and one-half months. So that, reasoning from this standpoint, speaking of irrigated pasture, of course, properly seeded, you can readily see that on the irrigated lands of the state we can grow an enormous quantity of feed and support a very large amount of stock.

One acre in alfalfa in the Yellowstone valley will grow from five to six tons of fodder. In the Gallatin Valley, where we grow clover, the average is about the same, and in other valleys from four to five tons will perhaps be an average. I presume in other parts of the state, around Chinook, they speak of five tons of alfalfa on an average to the acre; in the Bitter Root valley I presume about the same would be the returns.

Five tons of alfalfa will keep one head of stock for at least one year; and it will keep it so well that it will grow in liveweight during the time it is feeding on that five tons of alfalfa. So that you can readily see that it is a very conservative estimate, that on every irrigated acre it would be an easy matter on the average to grow nearly two head of livestock when we consider that 4-5 of our live stock is sheep.

There are some other points growing out of this, and I have felt almost tempted to tell a story Mr. Wylie was telling me yesterday and if it does not interfere with something he wants to tell, perhaps I will tell it to you. The illustration was this. He has a farm between two other farms, and on the question of the growth of this hay upon the land as contrasted with the method of growing grain without the hay, one man summer-fallowed and grew wheat, and another man grew the hay and got really more grain than the man who summer-fallowed. The one with his straw stack was feeding 15 head of cattle; the other man, on the same area, was feeding on the clover 150 head of stock—10 times as many by the growth of the clover crop. So the question is the getting of the largest amount of possible returns from the land. Now, in the past, as I have stated, the practice in Montana has been to grow stock upon the range, to allow the stock to run on the range, and if they lived through the winter a great thing had been accomplished; it made no difference whether those animals lost in weight. I have talked with people sometimes where the animal had lost as much as 100 to 150 pounds, but the fact that the animal was carried over and did not die was sufficient compensation expected from those animals.

I was talking to a gentleman, coming up from Dillon the other day, J. E. Morse. He was telling about a man with whom he was acquainted along the line of the Northern Pacific, and he said he would carry his stock over every winter; he had several stacks in his yard; if those animals lived during the winter season it was all right, and it made no difference whether they were half starved or not, if they lived. He had the hay there, but he did not feed it, wouldn't feed it, unless the animals were likely to die toward the spring then he would feed some little hay.

I was down in the eastern part of the state at Glendive during this past fall, and there I found the conditions were somewhat different. There were no hay stacks or straw stacks to feed to stock in the winter season, and I was told by a banker in Glendive that during a recent winter there were at least a quarter of a million of sheep died, frozen to death and starved to death down through that country. He told me himself that the company which he represented shipped out of that district 60 carloads of pelts. He said however, that he did not get all of them, and

that as much as 100 carloads were shipped out of that country. He also told me that he thought as much as 70,000 head of cattle died down through that country. Figuring the thing up in dollars and cents, and it seemed to me that nearly \$3,000,000 worth of livestock died during the past winter down through that part or region of the state on both sides of the Northern Pacific railway. Down in that same country the government is undertaking to build an irrigation canal. It will cost \$2,000,000; it will irrigate 75,000 acres; 75,000 acres of land put into alfalfa will grow enough feed to keep those quarter of a million sheep and those 70,000 cattle and feed them well for 365 days of the year. And the loss for one season, \$3,000,000, would build that canal and leave \$1,000,000 to distribute among the people to start their business.

It seems to me when we consider those things, that the livestock industry of Montana has got to be changed if we are going to get the largest possible returns out of it. The development and irrigation of that 75,000 acres of land would have saved \$3,000,000 to the state in that year in that particular district, because the stock could have been well fed and would have done well.

I have had a little discussion, in talking to the stockmen of the state, as to whether it will pay to feed the stock during the winter season or whether it will pay to starve them through, as long as they live, and then make the gains during the summer season. I had a talk with J. E. Morse of Dillon on this question the other day, and he was straddled the fence, as it were. He said, "We make good money out of our present way of handling the thing." I said, "Is it not possible you will make more money from handling it in a better way and take no risks, where as now, with a bad season, you take very serious risks?" The outcome of it was he made this proposition: "If you will weigh this stock and keep some track of the feed, I will furnish 100 head of calves, and we will put 50 of them in a feed lot, and feed them during the winter season, the other 50 we will turn out in a bunch and let them rustle for themselves during the winter season, and we will find, after we have carried those cattle through two or three years, exactly what are the results from that method of feeding." Now, I am not going to say what the results will be, but I want to say to you that I have had calves that at 1 year of age, that had not run with the cow for one week, that did not get any whole milk

longer than four to six weeks: I have had those calves at one year of age weigh 900 pounds. Now, if we can, by good feeding, during the next season add to those animals 400 pounds in liveweight each, we will have a 1,300-pound steer at 2 years old. He has kept up his good flesh; he has not shrunk away and gone down to a skeleton, and the result is when you fatten him you have a better animal and can command a better price on the market. More than that, you prevent the losses that are going to occur by letting them run on the range and I believe that at 2 years of age—24 months' of age—I can sell that steer, if fed in that way, at the top of the market. You will carry the other animal from three to four years before you get him as good, and when you fatten him you will not have as good an animal to put on the market; he will not be as good quality, and, as a rule, will not command the best price.

There are a great many points that we don't know about yet, but I am trying to plan, if time and finances will permit, of taking up that subject of Mr. Morse's and carrying on such an experiment.

I don't think that this means that we are going to do away with the range question: I don't think it means that we are not going to reap just as large returns from the range in the future as in the past. My idea in regard to that matter is that the range area should be conserved, that it should be handled in such a way as to maintain its productive ability to the highest extent, and then supplement that by feeding the stock, shorten the time that you are out of your money with such stock, and I believe the returns will be equally as great and the losses very, very much less.

Now, I think this practically covers all I want to say at this time. It simply outlines an idea and brings to your mind how you may help the agricultural development of the state, and it may help a great deal toward putting your livestock interests upon a safe, conservative and more profitable basis than at the present time. I believe it also means that, while the livestock industry at the present time is confined to comparatively few, it will result in many more people engaging in that line, and instead of having, as we now have, 7,000,000 head of livestock, we will have, in time, as many as Iowa boasts of or even more than that. So that the livestock interests of the state by this means will not decrease, but will undoubtedly increase, and mean more and more to the people of the state as time goes on.

THE SHEEP INDUSTRY IN ITS RELATION TO RANGE AND FARM.

By F. B. Linfield, Experiment Station, Bozeman.

I appear before you, not as a sheepman but as a representative of the Agricultural College and Experiment Station, an institution established for the benefit of the agricultural and industrial classes and we thus feel that we have a personal interest in such a meeting as yours. As the servants of the people—your servants, we desire to do all in our power to aid and stimulate the agricultural and live stock interests of the state. I am free to admit that in the past we have not done all that we might have done for the agricultural interests but the errors were in judgment not in intent. For the present we expect to concentrate every effort toward making our agricultural school second to none in quality, if not in extent. To this end I invite your co-operation and help for I am fully persuaded that if the stock men and farmers of this state will urge our claims for equipment there will be no difficulty about securing it.

Montana is the greatest sheep and wool producing state in the union yet there is not a single breeding sheep upon the college farm, because we have no place to take proper care of a good flock. There are many questions relating to the breeding, feeding and managing of sheep, that you would like to have answered, but we must wait until the stock and a place to take care of them are provided.

When you, or your sons and daughters come to see us, we would like to be able to show you and them some of the best samples of breeder's art, something that will stir up their ambition to try and build as the great masters in live stock improvement of the past have built, that they may have the pleasure, satisfaction and profit that comes from producing the best.

But that is only one of the directions in which we need your help. All phases of our agricultural work are in a measure dwarfed because of lack of room and equipment and we have come to a time when if we are to measure up to the demand made upon us, more generous facilities will have to be provided.

The inquisitiveness of the small boy is proverbial. I presume that this is natural as it is the means he has of groping his way

in to a larger acquaintance with the unknown world around him. This quality of inquisitiveness was strongly developed in myself and the habit seems to have grown with my years. As a servant of the people in the agricultural field I have tried to learn all I could about the agriculture of the state and of its agricultural and live stock possibilities. I have perhaps worried many people with my questions and others with my theories and on this occasion I must ask your indulgence while I present some of these theories for your consideration; not that they contain anything new, but that in a new setting they may invite your criticism and thus help myself and others to a better understanding of the subject presented.

Montana is among the largest of the states, containing about 93,000,000 acres; about 26,000,000 acres of this is mountains and forests. Some 38 million acres is classed by the U. S. government as grazing lands and about 30 million acres as farming lands—that is land with a soil level and rich enough to be farmed. Montana is also one of the best watered of the states as within her borders are the headwaters of several large rivers. There is no definite information as to the amount of land at present under irrigation in the state but it is certainly less than 1,500,000 and I am doubtful if it much exceeds 1,000,000 acres. Even if all the available water were used there will never be 10,000,000 acres under the ditch and it is doubtful if it will much exceed 5,000,000 acres in the times of any of us here present. This leaves 60,000,000 acres classed as farming and grazing lands that can only be used as pasture or for dry land cropping.

It has been upon the grass crop grown upon this large area of land that the live stock industry of the state has been built. An industry which represents a gross yearly income of from 15 to 20 million dollars. The stability and progress of the industry rest in a large measure upon the continued productivity of the range pasture. Those in the sheep industry are especially interested in this matter as it is an industry well adapted to range conditions and almost wholly dependent upon the range pasture for its existence.

It would seem that in the past the live stock and farming interests of the state have had little in common, which to an outsider appears rather an anomalous condition. This situation grew out of the peculiar condition of the past. The range found its market in the east—the farm marketed its produce in the

country and mining towns. The development and increase of the farming industry of the state is enlarging the market for the unripe product of the range, and the rapid increase in this development, promised in the near future, will bring increased competition for the range produce. The range as well as the farm is a part of the agricultural heritage of the state and the prosperity of any one phase of these interests will be to the advantage of all.

There is and always will remain an immense area in this state that will ever be used for grazing purposes. Very much of the area has a soil deep and rich and would only need the addition of water to yield large plant crops that few countries in similar latitudes could equal. From this area in the past the state has reaped millions of dollars worth of meat and wool and with proper methods of management it will continue to so produce for years yet to come.

The old time stockman who came to this country in the early days dwells with longing remembrance on the immense fields of waving grass that were found more or less abundant over the range, but especially in the rich valleys and sheltered coulees. Cattle and sheep grow, thrived and kept fat the year around. But now conditions have changed, the ground is bare, the grass eaten into the roots and the stock frequently find but scant picking.

To the question—what has brought about this condition? I believe the universal answer would be—the range is over-stocked. Undoubtedly this is the primary cause, but it seems to me there are other and secondary causes that may be equally as important and perhaps more fundamental.

We must not forget that the amount of crop we can get from this bench land is dependent upon the rainfall (including snow-fall) but especially upon the amount that soaks into the ground.

The condition of the range as described by the early stockmen, afforded ideal conditions for the retention of a maximum amount of precipitation. The grass held the snows of winter and in the spring, this thawing slowly, soaked into the ground. The spring and summer showers falling in a bed of grass did not quickly run off but percolated through the grass roots and much of it found its way into the ground. The grass upon this ground again acted as a mulch and prevented the rapid evaporation of the rain-water from the soil.

But with the bare ground of the present there is another condition presented. The snows of winter are blown off this bare ground and piled up in the coulees and when the spring comes it melts and finds its way through rivulets, creeks and rivers on and out of the country. The showers of the spring and summer falling on the bare ground run rapidly off to the some coulees and is lost, while what little soaks into the soil the hot sun shining on the unprotected ground soon drinks into the air. Under these circumstances is it any wonder that the grass is getting less and that the springs are drying up. The grass is nourished by the water that soaks into the ground and the springs are fed by the water that percolates down and through the earth. It is thus that our management, or rather lack of management has accelerated the destruction of the native pasture—has tended to destroy the goose that lays the golden egg.

At this point I would like to ask, have we properly diagnosed this phase of range difficulty? Remembering that the great—the all-important factor is water and this we must have in the soil to get a grass crop all our thoughts and energies must be centered on how to hold this water on the ground and get it into the soil. The improvement of the natural conditions above outlined might be helped by a system of small dykes, plowed on the range, making small basins where the water might be held and prevented from running off. In other places something might be done to divert the water that runs off into coulees, on to land lower down, in such a way as to thoroughly soak these areas in the spring. This would materially increase the grass on such land and even make it possible to grow grain and fodder crops successfully. Again I repeat, do not forget, that the water that falls upon the land is the life blood of the grass and thus of our industry, but it is only valuable as we can save it for the use of the plant crop. That which runs away down the coulees is forever lost to the country.

If we have properly interpreted the reason for the depreciation in our range pastures the next question is—can this range be restored to its old-time crop yield and if so how may this be done? As I have traveled over the range it has not occurred to me that, except in a few comparatively small areas, is there any need for re-seeding the range. The native grass is still there and alive and if given a chance will again assert itself. From what

I have seen of fenced areas of the range I believe that if protected for but two or three years we would again have the full grass crop of by-gone years.

I have conducted experiments for some years on the value of an irrigated pasture, my observations have led me to the conclusion that to get the maximum crop of pasture we must allow the grass to get a good start in the spring. This spring growth strengthens the plant and thus very largely increases its rate of growth and the annual crop.

From inquiries put to intelligent, observant men in all parts of the state, our present methods are cutting our range crop in half, or to put it in another way, if properly managed our range pasture would support double the number of sheep, cattle and horses that it now maintains. If this is correct it is a tremendous economic loss.

The logic of the fact seems to me to point to the necessity for some intelligent control or management of our range pasture if we are to get the largest crops from them. I am not prepared to discuss what the nature of this management and control shall be but as in a large measure the stability, progress and prosperity of our live stock industry is closely associated with the maintenance of the range pastures to their highest efficiency, this is a question worthy of our best thought.

Again, if we are satisfied that the cardinal points advanced, viz: that the present methods of management are seriously injuring the range pasture and next that some intelligent control is needed, it will not do to be satisfied with a negative stand. The positive side of the question demands an answer.

If the live stock interests of the west cannot, or will not, work out a plan of intelligent control, then the government must take hold as it cannot permit its public domain to be depleted and destroyed.

I have dwelt at some length upon the range part of this question because of its paramount importance to the sheep industry and must therefore curtail on other phases of the subject.

The range will, as in the past, continue to grow the sheep and wool crop of the state but there are several directions in which there will be an increasing interdependence between the range and the farm. The next five years promise a very large increase in the irrigated farm lands of the state and all parts of the state

are going to share in this development. Moreover I am foolish enough to believe that this is going to be a good thing for the sheep and other live stock interests.

A few hay stacks, whether of alfalfa, clover or peas, near the winter feeding ground of the flock is an insurance against loss which had it been available on many occasions in the past would have saved hundreds of thousands of dollars to our sheepmen. The sheep that winter well give a maximum crop of wool and a maximum crop of spring lambs—the double-headed crop, which brings the profits to the sheepman's coffers.

Thousands of dollars are yearly sent out of the state for high grade rams to maintain the standard of the range flocks and thousands more might be spent with advantage. Few men in the country have such favorable opportunities to improve their live stock and to maintain a high grade of quality and productiveness in the animal as have the sheepmen. Dealing in large numbers, a vigorous selection is possible. With a correct ideal in mind and a policy persistently and consistently carried out and with the use of properly formed and high grade rams, very great improvements could be made in the quality and amount of our range crop of sheep and wool. The result of this improvement will be most apparent when compared with the flock that has been produced under careless and indifferent management and a total lack of high grade selection.

I believe it is possible and highly desirable to produce all of the rams needed for this improvement on the Montana farm. The feed and climatic conditions of the state coupled with intelligent management will produce right at home a strong, hardy and an acclimated sheep and thus one better adapted for use on the Montana ranges than any imported sheep could be.

Experience and observation seem to teach that the Montana farmers must grow large areas of alfalfa, clover or peas if they expect to grow grain crops with the largest measure of profit. The only available market for much of the fodder is as feed for stock. The farm will thus continue to be a sharp competitor for the surplus stock of the range. Conversely, in both directions mentioned above, the farm will benefit from the proximity of the range live stock. It will find a profitable outlet for both feed and labor in finishing for the market the surplus stock of the range and in providing the high grade stock needed to keep up the quality of the range sheep.

Again the mutual upbuilding of a home industry and the keeping of the maximum of profits in the state is going to add very materially to the wealth and prosperity of all the people.

This subject might be elaborated much more fully but with these suggestions I must forbear. Perhaps at some future time we may pursue the subject further.

DAIRYING.

THE BEAVERHEAD DAIRY COW.

By Louis Stahl, of Dillon, Montana.

Gentlemen: A very grave mistake has been made in selecting me to address an intelligent gathering for farmers, such as this is, upon the question of "How to Conduct a Dairy." However, every one is liable to make mistakes and the best of us are often sinners in that respect, so I will ask you to be charitable towards Mr. Featherley, who imposed this duty upon me, and not to visit upon him more than his just share of the blame for the failure which I know I must make in attempting to address you upon this subject.

I have been engaged in the dairy business at Dillon for some years, and by virtue of a great deal of hard work, possibly some good fortune, and by strict attention to the details of my business have been able to at least make ends meet. My business has not been an extensive one nor have I grown old in the business and hence what I shall say to you could not be as instructive as it would be coming from one who is more extensively engaged in the business and has had a wider experience.

In conducting a dairy business, of course it is very important to have suitable and proper milch cows and climate must be taken into consideration in considering this proposition. I have found that a cross between the Holstein and Durham to be most satisfaction; however a cross between the Jersey and Holstein has proven thoroughly satisfactory. In selecting an animal for dairy purposes it is far better to select one whose mother is a good milker as your selection will in that event in every case prove satisfactory and profitable.

After having a properly selected lot of cows the most important thing which follows and which will make your undertaking a success or a failure, is the proper housing and care of the animals.

During warm and favorable weather this, of course, is a small matter, but in a climate such as this, good housing is an absolute

necessity. Cows do not do well and will not be successful milkers unless kept in a comparatively warm and strictly well ventilated barn. I do not advocate the use of artificial heat, although if the same could be done with comparatively little expense this might be an advantage but with the small profits resulting from the dairy business, artificial heat is out of the question so it is advisable to make the barn warm and so arranged that no direct cold draughts will reach the animals. Have the barn, for a distance of eight or ten feet at least from the ground, tight, but above that point have windows so that ventilation may be free and easy. In cold and unfavorable weather my cows are always kept in the barn. They stand on a plank platform which should be arranged so that all droppings from the cows will fall away in a gutter from twelve to sixteen inches wide and six to ten inches deep. The gutter, of course, should be placed on a grade so that the same can be flushed and easily cleaned. I usually keep my cows in the barn, tied up. This is advisable in all cases, where you have any number of cows.

The feeding of the cows is also a very important question. During the growing season any kind of grass is satisfactory but the best results are obtained from cows which are fed upon the native bunch grass. I find the milk greater in quantity and richer in cream and butter fat when cows are so fed. Cows may be pastured upon any other kind of growing grass and often on alfalfa, which is very satisfactory except it causes the cows to bloat, and of course very close attention must be paid to cattle when feeding upon growing alfalfa. In case of bloating you all know the proper remedy. During the season after harvest each year the cattle do splendidly in feeding upon the fields where the hay or grain has been taken off. The general diversity of the diet thus obtained produces good results.

During the growing season, especially when the cows feed strictly upon green truck, I find it advisable to use barley or some kind of chop feed twice a day, using about two pounds at each feed. This I always do and consider it necessary and far more profitable in my business.

During the winter months of each year, or which we should rather designate as the season when grass is not growing, the only thing we can feed in this section with profit to dairy cows is alfalfa hay. This produces the best results and is also the

cheapest feed from the standpoint of results obtained, though there is a great deal of difference in the results from the way in which alfalfa is put up. Properly put up, it produces the very best results, and improperly put up, the results are far from satisfactory. I have found in my business that it is almost impossible to get alfalfa properly put up for use in the dairy business. I raise and put up a part of the alfalfa which I use myself, and the rest of course, I have to buy. From experimenting with feeding alfalfa I have learned just how much and how far it should be cured to be the most satisfactory for dairy feeding. Not exceeding a day after the alfalfa is cut in ordinary weather it should be raked into windrows and immediately thereafter bunched by hand. It is claimed by some that alfalfa cannot be raked until the curing process has further progressed, but by taking out every other tooth of the rake you can easily rake any alfalfa; you can even follow the mower. The idea is that the alfalfa must not be cured very thoroughly. We want it as green as it is possible to preserve it. That is to say, the greener the better. Cows fed upon alfalfa put up as I have suggested produce a great deal more and far better milk. When I change my cows from alfalfa put up as I have above outlined, to alfalfa more thoroughly ripe I notice an almost immediate change in the milk produced. The amount of milk one obtains from a cow, decreases proportionately as the cow is fed green cured or thoroughly cured alfalfa. What I mean by well cured alfalfa is alfalfa that is let remain on the ground too long before bunching. I sometimes, of necessity, have to feed such, but I do not find it advisable when a different kind can possibly be obtained and I think that it is worth, in my business, at least a dollar a ton less, or to express it differently, with thirty head of cows I get four gallons more milk per day when using green cured alfalfa. I want to strongly impress upon those who milk cows for profit the advisability and the necessity of using alfalfa as green as possible. Alfalfa cut when the first blossoms appear makes much the better hay for dairy purposes. To let it stand longer more of the substance seems to be lost and the stems become woody and the cows not only will not eat it but will not do so well when such is the case. So in leaving this particular part of my subject, I want to say, cut your alfalfa early and don't let it stay on the ground after

cutting too long, and if you will follow this advice you will find alfalfa a most satisfactory winter feed.

I know it is the old theory, and a great many still continue it, of feeding bran or shorts with alfalfa hay. I do not find the practice at all advisable, in fact I strongly recommend the contrary, and only in case of an old animal do I recommend it at all and then it only serves the purpose of concentrating the food. I find the better feed with the alfalfa to be barley twice a day from two or three pounds each feed. The next to barley is oats and lastly bran or chop food. I believe it is necessary to feed the amount of grain I have named during the winter months but barley is far the best and more advisable from every standpoint. My experience is that a cow should be fed about forty pounds of alfalfa per day. I am giving the results of my experience in feeding my cows and I am sure that any one who will follow closely what I have done will readily testify to the correctness of my theory.

There is one important question which I was about to overlook and this I deem so necessary and material that I will here speak of it, and that is feed your cows like some politicians advise you to vote "early and often." I feed my cows before I milk, giving them only a small quantity of hay, just what they will thoroughly clean up. Cattle after breathing over hay will not eat it, hence it is most advisable to feed only a small quantity at a time. Any leavings after feeding should be cleaned away before the next feeding. Immediately after milking I feed again, using again such an amount as I think will be eaten, then water the cows, but don't use ice water, use spring or well water, and it is better if such cannot be obtained to use some means of heating the water before you give it to the cows. This is one place where I find that heat will prove especially profitable. A cow will not do well when drinking ice water. After watering I feed the barley and later in the morning I give a third feed of alfalfa. After they are through eating, if the weather is favorable, the cows should be turned out until about four o'clock in the afternoon. While the cows are out the barns are thoroughly cleaned and ventilated and before bringing the cows in, in the afternoon the evening feed of hay is placed in the manger. Again I want to direct your attention to the point, put only so much hay in the manger as the cow will eat. I milk in the afternoon about five o'clock,

while the cows are eating their hay. I do not use any bedding for my cows. I do not find it necessary and certainly it is far cleaner and I do believe that cleanliness is an absolute necessity in a well-regulated dairy barn.

It is not my purpose to go into the question of caring for the milk after milking. My subject commences and ends with the care of the cow, and to sum up in a few words I would say cleanliness, order, regularity in feeding, watering and milking, using proper food, using proper water and good ventilation of the barns, will render any dairy business a success if the proper kind of cows are selected.

I also find it very advisable to have on hand as large a number of boys of your own raising as is possible. The boys especially are a prime necessity. Don't overlook them if you are going to engage in the dairy business.

THE CREAM MARKET OF MONTANA.

By W. J. Elliott, Agricultural College, Bozeman, Montana.

Some of the city markets of Montana are calling for cream all winter. The price did not seem to be the factor for the dealers were willing to pay almost any price if they could get sufficient cream of good quality.

Now there is surely room for a little thinking along these lines for there are a great many localities in Montana where there are not enough cows to start a creamery, and the rancher is asking himself the question: "What shall I do with the cream I am saving from my cows; shall I make butter and trade it out with the grocer or shall I let the calves have it in the milk?" We think most emphatically that the farmer can feed his calves something that will not cost nearly so much as butter fat at 25c to 30c per pound. In communities where cows are comparatively scarce the farmers might club together and ship cream to some of the city markets where sweet cream of good quality is always in demand.

We believe that the farmers will by this method realize just as many dollars for their cream as they possibly can by making butter at home, and besides, all the bother and work of saving the cream and churning the butter is lifted from the shoulders of the oftentimes overworked housewife. In a great many in-

stances by looking into these questions the farmers might be encouraged to milk a few more cows where such a market is ready for the cream, and especially during the winter season, when the avenues through which the farmer receives his pay are very few. It is certainly very comfortable to have a herd of 10 or 15 good milk cows bringing in the ready cash every 15 or 30 days during the whole year. Of course where there are cows enough in a community a creamery or cheese factory is the thing, but as a method of getting up to that creamery or cheese factory it is well to look into these markets for cream, for we are satisfied that there is nothing like the actual dollars coming to the pockets that will bring a community more quickly to see the great advantages of the creamery or cheese factory.

Kind of Cream Wanted.

Cream for these city markets must be of high grade and good quality. Cream hand skimmed or that which has been saved for several days is not wanted because hand skimmed cream is likely to be lumpy, and cream that has been kept too long becomes "ripe." Only cream that is first class in quality can find a market but there is almost an unlimited demand for that of first quality. Dealers prefer cream of 35 per cent to 45 per cent butter fat rather than thinner cream, and this is really best for the farmer, for the more concentrated he can have the cream, the less skim milk he has to pay express on.

We are taking for granted that the farmer is paid according to the quality of the cream he delivers. That is, the cream delivered should be tested by a Babcock tester. We would not advise any man to ship cream to a merchant who buys only by the weight of cream delivered. Insist on having the cream properly tested and a report of that test returned with the empty can. Many progressive farmers believe in having a small hand Babcock milk tester on the farm to keep a check on all cream shipped. This is a good plan because mistakes are bound to occur, and when the farmer knows that the test he is receiving from the milk dealer is very close to the test he has made for himself he is much more likely to be satisfied.

BUTTER FAT IN THE FIRST AND LAST MILK.

By W. J. Elliott, Agricultural College, Bozeman, Montana.

What is the reason for the difference in per cent of butter fat in the first and last milk?

The above question may have come to a great many yet when asked why this peculiarity, the average individual is unable to give a reason. Indeed some, even though they may know that there is a difference in the per cent of butter fat between the first and last milk, do not know that the last milk may contain 10 times as much fat as the first. It is an actual fact, however that the first milk may contain as low as 1 per cent butter fat, while the last or strippings, may contain as high as 10 per cent, and even more.

Now probably a word right here, as to the source of the constituents of milk, may help us in our understanding of this matter; and in order to do this we will start out with three statements:

First: The udder of the average cow will only hold, in the milk cistern and milk ducts within it, from one pint to two quarts of milk, so it will be plainly seen that the great bulk of the milk, that a cow gives, must come from somewhere after the milker begins to draw the milk from the udder.

Second: The watery part of the milk, that is the water with most of the solids in solution, is an infiltration from the blood vessel and tissue of the udder into the milk ducts, which ramify all through the udder. Or perhaps we might put the second point more plainly thus: The watery part of the milk simply filters or oozes from the blood vessels and tissue into the milk ducts, which conduct the milk to the base of the teat, from whence it is drawn.

Third: The butter fat does not come from the blood vessels but is produced in special cells or sacks, called Ultimate Follicles, which are located along the sides and at the terminal points of the milk ducts. These cells produce the fat globules much more rapidly when the udder is manipulated or worked, as is done when the calf takes its "lunch," or as is done by the milker in the process of milking.

Now let us start from the time the cow is milked dry, and is turned out to grass. Of course as she goes about slowly gathering her food the watery part of the milk will still continue to

ooze into the milk ducts, and will continue to do so slowly, until the milk ducts are full. It may possibly take an hour or two for these milk ducts to become filled with milk, but during this hour or two nothing has been agitating the udder, so that the Ultimate Follicles have been producing butter fat but slowly. Thus the milk that is first produced in the udder consists of a large proportion of the water part, with but little fat. This is the character of the milk which fills up the milk cisterns and ducts, and hence is the first milk to be drawn from the udder, and thus is poor in butter fat.

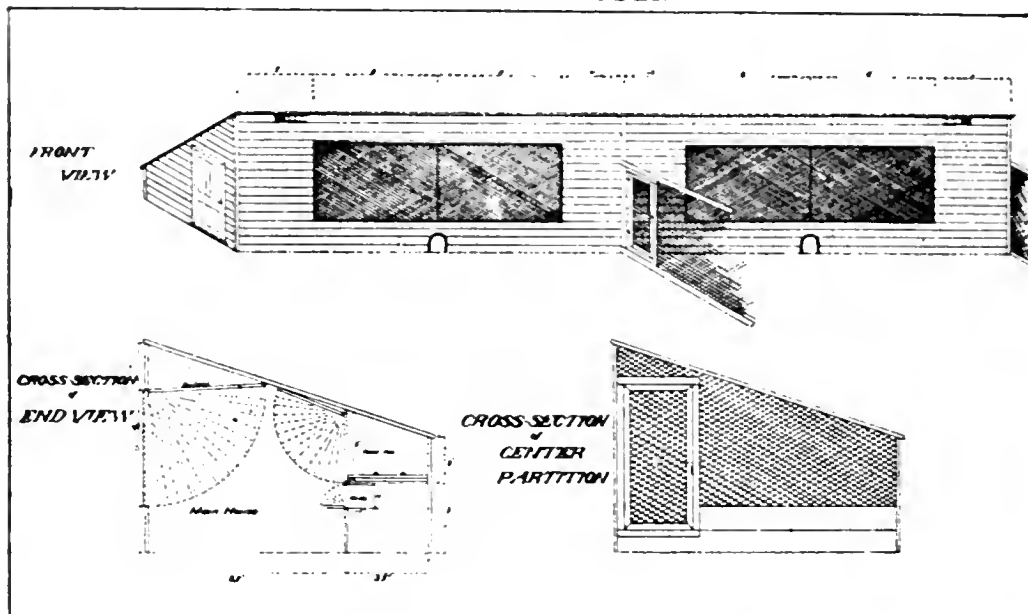
Now, after the milker draws this first milk from the udder the watery part continues to ooze into the milk ducts, and at the same time the action of the milker begins to agitate or excite the Ultimate Follicles to a more active secretion of butter fat globules. Hence as the milking proceeds we have a larger proportion of fat globules dropped into the milk, and thus the milk is becoming richer in butter fat.

As the milking process proceeds the blood vessels and animal tissue become depleted of their water and other constituents, or in other words, the animal system has given up all the water, etc., that it can spare and hence it begins to ooze more slowly into the milk ducts. But by this time the Ultimate Follicles are stimulated to their highest capacity of production and butter fat particles are being produced more rapidly than ever. Thus we have this condition: a lagging secretion of water, etc., and an active secretion of butter fat, or in other words, a product with a relatively high proportion of fat globules, which means a milk high in butter fat.

Thus from the time the milking process begins, until the time the cow is milked dry, a continually increasing quantity of butter fat is being produced, which explains for us, the poor "first" milk and the rich "last" milk or "strippings"

POULTRY.

POULTRY HOUSE.



FARM POULTRY HOUSE.*

By James Dryden, Utah Experiment Station.

To answer occasional inquiries I have prepared the accompanying plan of a poultry house.

The illustration shows a house intended for a hundred hens, and if good hens are put into it and given good care, it will pay for itself in one year. It may be extended to any length desired or cut in two for fifty fowls.

It is fifty feet long and twelve feet wide, nine feet high at front and five feet at rear, and divided into two sections by a partition of wire netting, with two feet of boards at the bottom to keep the fowls from fighting through the netting. The walls are of one board thickness and the roof is shingled. There is a curtain door of good factory on each section of the front. These are hinged at the top, opening inwards, and may be fastened to the ceiling. On stormy or very cold days these doors are closed, but at other times they are kept open. These doors are sixteen feet long and five feet high on each section, divided into two for

* From Utah Exper. Station Press Bulletin.

convenience in opening and closing. If it is desired to keep the fowls from getting outside there should be a frame of poultry netting placed over the opening. This should be fastened in such a way that it may be taken out when desired.

To keep the hens warm in cold nights a closed roosting pen is built on the back wall three feet above the floor. This gives the whole floor space for use of the hens during the day. The roosting pen is three and a half feet wide and sixteen feet long in each pen. It is built up tight to the ceiling on all sides, except the front, and should be lined with heavy building paper or tarred paper. On the front of this pen there is a curtain door, hinged at the top, which is closed down at night during cold weather. This door is three feet by sixteen divided into two sections. There is a platform about a foot under the roosting poles made of tongue and groove stuff, three feet from the floor. Under this platform there is a row of nests fourteen inches wide by twelve inches deep, making the nests fourteen inches long would give twelve nests in each pen. The bottom board is extended out at the back about six or eight inches for the hens to fly up onto and enter the nests. On the front there is a door or board hinged at the bottom. When the eggs are to be gathered this door is let down. The roost poles may be made of 2x4 pine, planned on all sides, with edges rounded off. They should be laid with the flat side down and should be fastened without nailing, so that they may be easily removed for cleaning.

The building should face the south to get the benefit of the sun in winter and should be located on perfectly dry porous soil.

Such a house will give the fowls an abundance of fresh air at all times and warmth at night. The cost need not exceed \$100 for labor and material.

THE POULTRY BUSINESS AS A PROFIT-MAKER.

By James Dryden, Bozeman, Montana.

There are several ways of looking at this subject. One is the way a certain lady looked at it who said: "I know there is money in the poultry business because I have put a good deal into it and never got any out." The ladies, by the way, are interested in poultry keeping more than the men, and for several reasons. There are probably twenty-five million ladies, young and old, in the United States who wear dresses. I won't vouch for the rest of them. I read the other day that there were some thirty ladies in New York City who spend about \$100,000 a year each on dresses. A great many in that city, several thousand of them, spend a thousand dollars a year each on clothes. A great many in the United States probably don't spend more than five dollars each on garments. Now, if they average ten dollars each that would mean \$250,000,000 a year for dresses. That money doesn't all come out of the pockets of the men. Of course it doesn't all come from the hens; the hens have to furnish the groceries, too, you know, as well as the shoes for the children. But a good deal of it comes from the chickens. When the farmer is off his guard the wife goes out quietly to the granary and smuggles a lot of wheat into her apron and feeds it to the hens; and if I were telling ladies how to make dresses I would teach them how to make an apron with a good big pocket or grain bin in it, and if his lordship asked me why I was wasting so much calico on that pocket I would tell him kindly that that was my business. When the farmer gets a little lonesome and hooks up his team to go to town to stand on the street corner and have a good time generally, his wife puts on her best smile and says: "Please may I go along?" She smuggles a basket of eggs under the seat and borrows half a dollar from the lord of the realm. She comes home with a ten dollar dress and a lot of groceries, and his lordship is proud of his wife. Bought all that with half a dollar. Why if it were not for the old hen millions of the dear ladies of the land would be trying to get along without dresses rather than try to deprive the old man of his tobacco.

There is another way of looking at it. The State of Montana produces according to official statistics, between a million and a million and a half dollars worth of poultry and eggs every year.

This is a lot of money for somebody. That money stays in the state and helps every industry in the state. Another thing, over a million dollars' worth of poultry and eggs are shipped into Montana every year from other states. That is also an enormous sum of money that goes into somebody's pockets, but it doesn't go into the pockets of the people of Montana. It is just that amount taken out of our pockets that goes to some of our neighbors in other states to help clothe and educate their children and build up and equip agricultural colleges, while our own rich state is too poor to give a few thousand dollars to the institution on the hill here to encourage the agricultural industries of the state. Why the money that this state is losing every year, money that is being sent out to other states for poultry and eggs, would pay all the state taxes and in addition would build up an agricultural institution in Bozeman worthy of the great state of Montana. Among other small things recently asked for, the college authorities asked the legislature for two thousand dollars to equip the poultry department for more efficient work. We believe with proper facilities this department would be instrumental in a few years in saving to the state the million dollars that go every year to other states for poultry and eggs. I believe that, given proper facilities for doing some educational work, for demonstrating the possibilities of the poultry industry, for investigating different methods of poultry keeping and feeding, in a few years it would result in keeping this immense sum of money at home. The fact is the people of this state are probably paying more to the support of the agricultural colleges of Kansas and Nebraska and of the Dakotas than they are contributing to the support of our own agricultural college, because Montana is sending out to those states millions of dollars every year for butter and cheese and eggs and poultry and other articles that might be produced as well at home, and that money helps the farmers of those states pay their taxes, and their sons and daughters are given educational opportunities that are denied to the sons and daughters of Montana. But I am wandering.

I have been asked to tell you about the profits in poultry keeping. My knowledge of this subject has been gained chiefly through experimental work at the Utah Experiment Station. It has also been my privilege to visit some of the large poultry districts in the United States. Now, the profits vary in the poultry

business just as the losses vary. We found in our experiments that it was just as easy to make a loss as to make a profit. The profits depend on several things, on many things. For instance we found that no matter how we fed her, how we treated her generally, the hen after she had lost her teeth was no profit-maker; she was a loss-maker. After she had lost her teeth she was like Dr. Osler's sixty-year old man—the only way we could get a profit out of her was to chloroform her. We found, on the other hand, that it was possible for a young inexperienced hen with a full set of teeth, to make two dollar's worth of eggs and more on about 60 cents' worth of food. A few weeks ago I had a letter from the manager of a large ranch in western Montana inquiring where he could get a good man to take charge of his poultry. He said they had a large plant but had yet been unable to get a profit out of the business. On further inquiry it was learned that the fowls kept on the place ranged in age from one to four years. If the business had been properly managed in every other respect this one fact was alone sufficient to account for the failure of the enterprise. Now a hen has few teeth, if any, after she is four years old, and I suppose in this case half the hens were living on the profits of the other half. A man has no business to say that there is no money in the poultry business who keeps his hens more than two years. Chloroform or the hatchet should be used then.

There are many other things affecting the profits; the age of the hen is one. The country, you say, is strewn with the wrecks of poultry plants. That is true. There are more wrecks than successes with large poultry plants. I have heard of several large costly plants in Montana that are practically wrecks. That does not prove anything, however. If 99 in every 100 poultry plants fail and one succeeds that would be evidence that there is money in poultry if we can only get it out. I know of poultry plants that have made money, and if one person can make it then another can by using the same methods.

The experiments that I have made with poultry show a profit of over 200 per cent on cost of food eaten. In those experiments all the food eaten was weighed and charged against the hens at market prices. With wheat at 50 cents a bushel we fed Leghorn hens at 60 cents a year, wheat constituting half the food eaten. At present prices the cost would be about 75 cents. But there

is more profit now than there was then because the price of eggs is so much better. At the present prices of foods in Bozeman I believe Leghorn hens can be kept for 75 cents a year each when all the food is paid for at market prices. Plymouth Rocks will eat about a dollar's worth of food a year, and Wyandottes about ten per cent less.

In number of eggs laid during the year, the Leghorns averaged about 150 each during the first year or when they had a full set of teeth. Those eggs sold for about \$2.25. At Bozeman prices they would sell for more than \$3.00. If you deduct the cost of food, say 75 cents, from \$3.00 you have a profit on the cost of food of \$2.25 per fowl. That is, 75 cents worth of food made \$3.00 worth of eggs. That is making a pretty good use of food. This doesn't allow anything for labor nor for interest on investment. The hen can be sold at the end of the year for as much as it costs to raise her. The interest on investment would be a small item. The labor item is somewhat doubtful. On the farm where fifty or a hundred hens are kept the question of labor need scarcely be considered, and the cost of food would be practically half what it cost us when it was all paid for at market prices. On the average farm at the present prices of eggs and food in this county one hundred hens could be kept at a profit of \$200. But in commercial poultry keeping such as I saw last year in a district in California where the poultry was the main item of the farm, it is a different question. There hens were kept by the thousand; in some cases I believe there are over 10,000 hens on the farm. The food and labor question must then be met on a business basis. I was surprised to find on those large poultry farms that one man could take care of about 4,000 hens. The work included the feeding of the hens twice a day, the gathering of the eggs, the cleaning of the houses and the moving of the houses, for the houses there are nearly all built on the colony plan, that is, they are moved on to fresh ground every once in a while. The work of running the incubators and brooders and hauling the feeding from town was done by other help. With our long winters here the labor question would be different, but if a man can take care of half the number of hens here, or even one-quarter the number I believe you could figure out a greater profit from the poultry than from any other branch of your farming operations. The

magnitude of the poultry industry at Petaluma, Cal., would convince any doubter as to the profits in the poultry business. Petaluma is a town some large than Bozeman and it has been built up and supported almost entirely by the poultry industry. Everything is eggs there. You hear nothing else talked of scarcely on the trains and on the street corners but eggs, eggs. Last winter I was shown figures of the shipments of poultry and eggs from that town for the previous year, 1903. The output, without including the eggs and chickens consumed at home, was 3,407,334 dozen eggs and 32,535 dozen poultry. These eggs and poultry brought into that town over a million dollars. Think of it, in one town, about as many eggs and poultry shipped as are produced in all the state of Montana! I understand these figures were exceeded by some 86,000 dozen eggs and 750 dozen poultry last year, 1904. I believe the prices of eggs are better in Montana the year round than they are in California, and the food is also cheaper here.

Now, I don't want you to think that the poultry business at Petaluma is an invariable success. There are many failures. I saw one poultry house 720 feet long and 18 feet wide that was about deserted, the business having proved a failure up to that time. But there were cases where money had been made out of the hens, nothing but hens. For the benefit of some of the cattlemen here I will tell a story I heard there on very reliable authority. Some fifteen years ago a woman and her husband lived on a farm a few miles from Petaluma. The woman began keeping poultry. The husband was a cattle and horse man; his tastes ran in that direction, and his name was seldom mentioned. Their place was heavily mortgaged when the lady began taking an interest in poultry. She got a few hens, the next year she had more, and the next more, increasing her flock every year until she has now some 10,000 laying hens and she has cleared \$30,000 from her venture. She paid off the mortgage with the eggs, just eggs, bought another farm and a lawyer in Petaluma told me that he knew of a mortgage that the lady held on some property of a client of his for \$12,000 drawing good interest. Now, then, if all the other poultry enterprises at Petaluma had been failures, though they were not, this one example proved the fact that there is money in poultry.

Two or three years ago I visited a poultry farm near Albany,

N. Y. The owner Henry Van Dreser, a noted farmers' institute lecturer of that state, went out of the dairy business nine years ago and took up the poultry business. He keeps about 3,000 hens now, and during the nine years he says he has cleared \$17,000 on the business, and the first few years he was conducting it on a small scale and with little or no profit.

I don't want you all to start in the poultry business and put all your money into it. To dissuade you from doing this I will tell you another story. Several years ago a man in Cleveland, Ohio, who had grown wealthy in business in that city, started a large poultry plant, probably the largest in the United States, for it is said he had put \$100,000 into it, and a few weeks ago I was sorry to read that the whole plant had gone into the hands of a receiver.

The great trouble or the great cause of so many failures in the poultry business is that the people rush into it after having heard an institute talk or read an incubator catalogue without first having learned the business as any successful business man learns his own business. There is only one way to learn it; that is by doing it. Of course we want to read all we can of poultry literature, books pamphlets, bulletins, etc., being printed now-a-days, some of it good, some bad and some indifferent. There are more journals devoted to poultry keeping in the United States than to any other branch of agriculture. There are more than half a hundred poultry journals devoted exclusively to poultry, published in the United States. Most of the experiment stations and agricultural colleges are taking up the study of poultry and poultry keeping. Scientific investigators are investigating the hen. And why not? The American hen does a business of over \$300,000,000 a year in this country and that largely through a system of neglect. It is no child's play to make a success of the business. Many a bright man has failed in the business and afterwards made a success of teaching school. Because a man is a successful institute talker is no guarantee that he would not make a miserable failure of life as a chicken man.

I have talked a good deal without saying anything, and if you will forgive me for what I have said I will summarize a few points which must be attended to if the poultry business is to be made a profit-maker.

I would say, first, before you get any chickens provide a house

for them. Chickens don't do well roosting on the dashboard at night and standing on the dunghill during the day.

Second, get a good popular breed and stick to it. One breed is enough.

Third, in buying chickens pay more attention to the strain or the individuals than the breed. Hens of the same breed lay all the way from one dozen eggs a year to 20 dozen, and you can't tell by looking at the hens which are the best layers. I have found several cases where the hens never laid an egg during the year. There is more difference in individuals than in breeds.

Fourth, don't keep the layers more than two years, better only one year. On an average during the first year a hen will lay with good care about 150 eggs a year, about 100 during the second and about 75 the third, and less each succeeding year. The first year they make a good profit; the second year they may make a profit, but the third and later years they were kept at a loss.

Fifth, to make winter layers the chicks of the larger breeds should be hatched in April and of the smaller breeds a month later.

Sixth, in feeding give the hens all they will eat of the right kind of foods. Give a variety of foods. Wheat may constitute half the food. They must have animal food of some kind; fresh meat scraps from the butchers are good, skim milk is good. Skim milk fed with dry bone makes an excellent ration and takes the place of cut bones and meat. Grit is just as essential as grain and it should be fed just as regularly; the sharper the grit is the better. They must have green food; clover or alfalfa is about the best kind of green food. The yolk will be very pale in winter unless this is fed. Then give them all the good fresh water they want. The weight of the egg is sixty per cent water, and in selling eggs at 30 and 40 cents a dozen you are getting about 25 cents a pound for water, which is a good deal more than Prof. Elliott and his dairymen get for the water they put into the milk.

MISCELLANEOUS.

ADDRESS TO STATE HORTICULTURISTS.

By Col. W. F. Sanders.

Mr. President, it seems not wholly strange to speak at some place where you preside, for it has been to some extent a habit of mine for something more than a generation.

I am a little discontented with the representatives of the Mayor and the Governor, but as finding fault is one of the steps by which we progress, I want to express my dissatisfaction. The gentleman did not specifically and definitely welcome to this town and this meeting the fair lady who honors us with her presence and who is entitled to gracious welcome here. In behalf of the private citizens not officially misled, I will take the liberty of stepping outside of what they have said and promising, I think I may say, that she shall not be the sole representative of her sex at the future meeting of the society. (Chairman Harlan: I hope not.)

The suggestion of the President that I should say something with reference to whether in my view the Horticultural Society is justified in its existence has recalled to my memory some facts. I had not been in town at "The Grass-hopper" more than a week or two, when I was told that a gentleman had arrived from the Oregon country with a wagon-load of potatoes,—a vegetable, a tuber, which, so far as I should see anything in the soil or knew anything in the history of the country, it was impossible to raise in this country, and I half suspected that he brought them from Oregon. However, going down by the side of the stream I found there a wagon-load of potatoes, the most remarkable for size and substance of any that I had ever seen, and having told my wife about it she said she would go in the morning and get some. She came back, and that day she weighed one of them and said it had cost her two dollars. It was an immense one, and she had paid for it in the government currency of the country, which then I believe was good for about fifty cents on the dollar.

It seemed strange that this arid country was capable of producing such a vegetable as that; but here it was; that, there was no denying. The man sold his load of potatoes, and I believe subsequently came back with another load. The Oregon country from which it came to us was as far away as Alaska seems now, and it was down on the St. Mary's or Bitter Root River that those potatoes were raised. They surprised me as much as this showing that is made here to-day of this other, and I will not say better, fruit, for there may be some Irishman present who might make a mush with me if I did, and I am rather inclined to endorse his view of it, if that is what it is.

It is more than a generation ago that I went down the Bitter Root Valley one time, and, having heard that the Bass Brothers were able to raise fruit, I went up to their ranch—"Pine Grove" I believe, and they presented to me an apple which, so far as I know, is the first one that ever grew there. I did it up very carefully and brought it to my home and presented it to my wife, who filled it with cloves, and that apple is now in my cabinet at my house, a curiosity. I hardly think we should have kept it with the care we did had we known what was to succeed it and this beautiful display was to follow. But, so far as I was concerned, I distrusted somewhat the capacity of this country for fruits like this, although some of the gentlemen in the Bitter Root Valley assured me that the industry was capable of development there to an extraordinary degree.

It is a great country to live in that is more than one story high. Down in the lower agricultural regions you get the grows on top of the ground, and that is all you get. Here in Montana you get, in the first place, what is underground,—the gold, silver, the copper, the lead, the iron and the coal; and that is a resource; it is a part of our wealth. On top of the ground we get potatoes; we get other vegetables and fruits. And in the sky we are able to transform sunshine and air into such beautiful forms as there. Now, it must be apparent to any political economist that a country that presents three or four stories of production is much better, is four-fold better, than the country that produces only one. And that is the beauty of Montana. It is one of the wisest of the provisions of this Society that it shall be ambulatory in its exhibitions and fairs; and while it may fitly enough in season hold its summer exhibitions in the vicinity where most

of this is raised, I agree entirely with the president that a time will come when all over this State it will have been ascertained where fruit can be most securely grown—for you have got to protect it against the high winds as well as other troubles—and that it is destined to be one of the great fruit-raising countries of the world. I have been able the last few years to compare the fruit which you raise here with that raised in most of the other countries in the United States and Canada, and I think in many respects the fruit that we raise here is superior to any raised elsewhere.

I am particularly glad that this mid-winter fair is held here and now. The members of the legislature, the gentlemen attendant upon it and visiting it, come from all portions of the State, and I think they will be much surprised at this exhibition, some of them who have not seen it before, as I was when I first saw your exhibition at Missoula, and that they will carry to their homes a statement of what you have done, and incite the ambition, and the cupidity if you please, of their neighbors so that they will proceed to plant trees that promise something of profit to the owners. We have been engaged for thirty odd years in setting out trees here in Helena until, in various places, we have shade trees growing of considerable value; and yet I have often thought how much better it would have been had we set out fruit trees instead of these shade trees indigenous to the soil. In the first place, during their blossoming season and during their season when their fruit grows, they are much more beautiful than any shade tree, and they are of utility; and it is gratifying to know that in the towns of the State and throughout the country people are taking their cue from the western portions of the State and are beginning to raise fruit. Everything of this kind operates upon our civilization, tends to strengthen it, tends to refine it, tends to make it conform to what is highest and best in political economy and in ethical culture, so that it is not merely a matter of dollars and cents, it is not purely sordidness that makes us desire to have this industry prosper. I beg to assure the ladies and gentlemen present from abroad that as the knowledge of this exhibition shall go through the town, the interest in their meetings will certainly increase and the attendance also. It is a misfortune of the city of Helena, and it is unfortunate that it obtains elsewhere, the newspapers confine themselves to sordid

considerations largely ; some of them do ; and if you get anything about the Horticultural Society before the people in the shape that will attract their attention, it has got to be the work of some person interested in the matter, and that has another tendency, and that is to make the people distrust what is published on that subject. In former times when newspapers were responding to the public curiosity and public want, instead of the private purse, why, what we read in the newspapers, to a certain extent, outside of politics at least, we believed, and our attention could be attracted by what was said. Now, if you get to mention the Horticultural Society, folks will say: "That is formal ; that is perfunctory ; I don't know whether we had better go or not, whether it will pay." But certainly these beautiful tints, these beautiful fruit, show what this earth is capable of, and the contrast which it presents between Montana as it now is—the abode of three hundred thousand people, with comfortable homes, with the laughter of children making music in them, with the presence of gracious women, and pictures and flowers and carpets and books, libraries and schools and colleges and churches—contrasted with what it was when my friend Mr. Harlan came, the abode of snakes and hostile Indians, is a conquest the like of which few men in any generation or in any land have ever seen, and which must certainly impress those who have experienced the change and the great service that has been rendered to mankind by the conquest of the State of Montana.

DISCUSSION OF THE HORTICULTURAL LAW OF MONTANA.

By Col. W. F. Sanders.

Mr. President, pardon me for a moment. Nobody has pointed out any defect in the existing Horticultural law. I am satisfied, not having read it with special reference to this motion or discussion, that the existing law is, so far as law is concerned, an adequate protection. If, as a matter of fact, as Gov. Smith says, the fruit inspector has surrendered to the fruit merchants and fruit dealers his official stamp, they and that man are guilty of an unlawful conspiracy and should be prosecuted. You may pass all the joint resolutions you want to, through the legislature or through the board of aldermen or through the church organizations. Those are the Pope's Bull against the Comet; they don't have any effect. What you want is the enforcement of the law as it is. I couldn't think of any suggestion to add to the present law, except to say that this law is intended to be enforced, or it shall be the duty of the proper officer to enforce this law, or it shall be the duty of the citizen to obey it. What would that amount to? Nothing at all. What is needed is prosecutions for offenses, for violations of it, and I do not think it would be wise for this society to get together and content itself by binding a committee to consult the Governor about this thing, unless you have got a definite law that is different from the existing law and that will have some effect. It looks to me that that is the thing to do. I would like to enquire of my friend if the fruit inspector is a Heinze man or an Amalgamated man? Does he belong to Peter Breen or Scallon. (Laughter). I should say, if he was an Amalgamated man, remove him and appoint a Heinze man; and if he don't enforce the law, appoint a socialist, and if he don't enforce it, appoint a populist, and if he don't enforce it, appoint a laboring man, and if he don't enforce it appoint an anarchist or anything else. Get at the law. It is a remedy and not a false mission. The trouble is, the more laws you get on the statute books that are not enforced the worse you are off, and if you should add another law you have not got one inch in advance. This does not apply only to this particular law and its enforcement; it is true of the whole State of Montana. Every man who sees a wrong, instead of going and hunting up the existing law and righting it according to that law, runs off for

a quack medicine to the legislature and gets more confusion into the books. If they should not pass another law up there, except the appropriation laws, they would entitle themselves to the everlasting gratitude of the people. What we want to do is to back down and find the law as it is and enforce it, and when we have got it enforced then we will know whether there is any defect or not. But you don't know now; not the best lawyer in this State knows. Laws are made to be obeyed and not to be sold out. Now every law that you pass is patronage; if you will do so and so, if you have got influence, if you belong to this or that clique, we will let you violate it, wink at it. So it goes. The defect of Montana is that it is not a government of law; it is a government of influence. That is what George Washington called it, and he said influence wasn't government. The old fellow thought he knew; I think he did myself; but he is unpopular in these modern days. His definitions couldn't get into the political dictionary of Montana. Laws are run over, disobeyed; influence snaps its finger in their face and don't care a straw. Now, until the people come back to their own rules which they prescribe in the statutes and say, 'These shall be obeyed,' there ain't any use putting anything more in the statutes at all; it is folly. And it is fair to say that this large force which I have denominated influence—that Mr. George Washington did—is very much interested in seeing that people do not get together and enforce their laws: "We want to control these things; if you will disregard the statutes and constitution and turn this thing over to us, we will run it in our interests and suit ourselves. The humble individual may squirm all he has a mind to; we will snap our fingers in his face; he is our victim." That is the infirmity of conditions in Montana.

CONTINUED DISCUSSION OF THE HORTICULTURE LAW.

By Col. W. F. Sanders.

Mr. President, I am one of those who believes the law is adequate and it cannot be much improved, if it is interpreted to carry out its designs and ignoring all those little technicalities that are found, technicalities that are generally found by Justices of the Peace and small courts that try to escape the responsibilities of enforcing the law.

Our system of government proceeds upon the hypothesis that it is the province of the legislature to define rights within the limits of the constitution, and that courts haven't any business to say: "Here is the law and it provides such and such action, but does not provide ways to enforce it, and therefore I may grant amnesty." What the courts have not the right to do, executive officers have not a right to do. Discharge of official duty is compulsory; any decision which impairs that is an abdication of the rights of the people. Now, if this is a bad law, if it is a law that the fruit inspectors have a right to say they will enforce one month and won't enforce some other month, it ought to be enforced all months. It is their duty to enforce it. Then the legislature would have before them an object lesson and know what to do. I should think it a little strange if that law was interpreted to provide that you have got to find in an apple a codling moth and find him attending to his knitting.

I don't know but the law is foolish. I don't know that you can enforce it without, (as it reads), it being harmful to the fruit growers of the State. If so, it ought to be enforced, and they can come up and make a row and have it changed. Perhaps it is impossible to get any law on such subject without now and then a wrong would occur, but what you are trying to do is to help the industry as a whole. If you say you will not enforce the law because, (even though it is possible of enforcement), in some instances it might do a wrong, you have abandoned government to begin with; it is an abdication of the functions of government. I am not blaming anybody. I am a little surprised that anybody should say or hint or think that when an inspector of fruit hands his stamp, which is the sign manual of the State to be used by him, over to the man who is interested in having it used upon his own property to the end that he may sell it, that

there is any justification or excuse or apology for it. That is a crime. That is a conspiracy between the fruit inspector and fruit owner to do an unlawful act. That stamp is given to the fruit inspector and he is charged with the duty of ascertaining whether according to the law it belongs to a box of fruit or not, and when he abandons that and when the man who owns that box of fruit says, "I will take it and I will consult my interests in the matter and I will use it for you," that is an unlawful conspiracy, and the parties who do it ought to be prosecuted. It is said it is difficult, that the fruit inspector has to have the element of ubiquity to be in six places at once. Let him hold the fruit until he can discharge his duty or else resign. It is a strange hallucination that men suppose they can hold office and abandon the duties of the office. If he cannot discharge the duties of his office then he should resign; for as long as he holds the office he should discharge the duties. This is a slipshod method of getting along, listening to this influence and that influence and paying no attention to the law is harmful in every way to the State.

These gentlemen are all interested in this; they have added a great deal to the capital, to the welfare and resources of the State, but the laws as they are in the statute book should be enforced; they ought not to be there unless they are of consequence, and if they are of consequence it is the right of all the people of Montana to have them obeyed. And I don't feel well satisfied when anybody comes here and says, "Why we can't enforce the law." I don't think it ought to be accepted as an excuse. I think the law should be enforced, and it couldn't really hurt my feelings very much if some of those car-loads of codling moths which come up from the Payette region of Idaho stood on the tracks of the Oregon Short Line or were destroyed by the proper authorities. The result of it will be that it won't be so profitable to ship in this succotash or whatever you might call it. You have raised the abstract question that has been discussed and decided for two or three thousand years, and that is whether a government of law is better than a government of expediency; whether AB shall be emancipated from obedience to the law because he says that if it is enforced it will do him wrong. That is a question addressed to the legislature entirely. The trouble with us is that we do not respect the law, and we are not to blame

so much for that,—the legislature sticks its nose into all trifling affairs, whereas legislation was intended only for the greater matters that concern man, and it is the multiplicity of laws that looses its grasp and denies obedience to itself. Matters that are small can be regulated by disciplinary forces. Public opinion is confused a little as to the sources of information. When a man wants the truth he don't want to go to a lawyer; he wants to go to the testament; the bible. I am sorry to say—I confess it humbly—that there are men who hang out signs and are equipped with advice at five dollars or ten, as the case may be, who really are not lawyers. They are paid to give this, that and the other opinion, according as the man who gives him the money wants the opinion. delivered. Now, if a person is going to take that kind of advice and consider it the very truth, finally he will get into a tangle and confusion which will make him crazy not unlikely. There are laws that touch upon matters of such little moment that the courts sometimes, the responsible prosecuting officers sometimes, think they would not be justified the taking up time to secure attendance for that. That is dangerous ground to stand on, but I think it is justified in instances. A fragment of that principle is found in authority given to governors to pardon and in the latitude given the courts and juries of our States to fix the punishment shorter or longer, as the case may be but I do not believe anybody can stand before the intelligence of the country and before the experience of mankind through all the years of its history since we have had any history, and maintain the proposition that there is any better way to regulate things than by law, and I believe the law should stand as the laws of the Medes and Persians, and it should be enforced. General Grant, whose rather good sense came to this subject one time, says: "If you have got a bad law on the statute books enforce it, and then maybe they will correct it." That may be a bad practice for a man whose car of apples stands on the sidetrack rotting. But it is for the general interest, and that general interest requires that a rule shall be adopted and that that rule shall be obeyed. And I am astonished at the proposition that a law passed to protect a great industry and officers appointed to enforce that law may abandon their duties simply because they cannot discharge them. They can discharge so much of them as is required or as it is possible to discharge, and if there are not hours enough in

the day they will certainly be excused for any criminal penalties for not discharging them! But if we should undertake to enforce this statute, it can be changed by the legislature, more inspectors can be found, and Gov. Smith has really put the rule down. You can look over a load of hay, for instance; you don't examine every straw, but you examine so much as is necessary to determine in your mind whether it comes up to a certain standard which has been set. The laws are printed; they are printed that they may be brought home to the knowledge of men; they read alike to everybody, and this is true of statutes as it is of all other books. In a little adage which is carved upon our beautiful congressional library: "Books will tell the truth when counselors, even lawyers, blanch." I don't think it is safe for a man to go to a lawyer, who tells you that a governing law is unconstitutional, and for him to disobey it. There should be some authoritative declaration of it, and we have had some experiences of that kind that I think have turned out to be very unsafe guides.

THE FARMER AND MERCHANT.

By F. J. Erfert, Missoula.

You have asked me to speak for a few minutes on the "Farmer and Merchant," but I am afraid I cannot do the subject justice as it is quite a subject, indeed, and I do not feel equal to the task, although I have had some experience in both lines. There are so many things one could cover that time makes impossible on this occasion that I am going to confine myself to just one of the principle products between the Farmer and the Merchant.

In my early life I put in some long days and hard work on the farm, and in later years, some long days and nights trying to learn merchandising, so I know something of them both. I know, too, that if the farmer thinks he has all the hard work to do, he is much mistaken, for the path of the merchant is not strewn with flowers, nor is his life one continual round of pleasure. And while the young man from the "Ranch" nowadays seems to think it a good thing to get to the "City" and go into the "store", he soon finds it not so easy and often wishes himself back on the farm, which is a pretty good place to be.

Farmers are like merchants, some good ones and some awfully bad ones. The farmer has to use judgment in planting his crop, and take good care of it while it is growing, if he expects good results. The merchant has to use good judgment in buying his goods, and take good care of his business if he expects good re-

sults, and sometimes the merchant's business is not as easily taken care of as the farmer's coming crop. But if the farmer neglects his work, the result is a failure of crops. If the merchant neglects his business, the result is the same,—a failure of profits and he goes out of business.

The farmer is the producer, the merchant the distributor of these products to the consumer. Without the farmer the merchant could not do business, and without the merchant, the farmer could not market his products, so they must work together hand in hand. Especially is this so throughout Montana, perhaps with the single exception of Butte, where the merchants depend on the trade of the miners altogether.

I do not believe there is a locality in the United States where the farmers are more independent of the merchants than in this part of Montana. This is brought about by the fact that our merchants pay cash all the year around for the farmer's products, enabling them to pay cash most of the time for their wants, although the merchant is always ready and willing to carry a good account with the farmer until his crops are harvested.

To be honest and truthful, I would not advocate a Farmers' Union, whereby they could establish retail stores and market to the consumer direct, thereby cutting out the profit of the middleman,—the merchant,—for we want that ourselves (as we want everything that is good, of course) but I would like to see a Union formed, whereby they would appoint inspectors to grade the produce for as it is now, every man expects the same price as his neighbor for his goods, no matter what is the quality of the product; a potato is a potato, an apple—an apple, with him, and you couldn't tell him anything else.

I wonder if any of you ever were in a position, where you had to tell a woman that she did not make good butter, and you could not take it, as your customers refused to buy it from you. I hope not, and if you ever do get there, I advise you to have a bunch of tall timber handy, for she will certainly drive you to it.

The merchant wants to be fair with the farmer, the farmer ought to be fair with him. He gives him good sugar, coffee, clothes and molasses; he, in return, should get good potatoes, hay and grain. That is only fair dealing, but does he get it? Not in many cases. I have known the merchant, after waiting six or eight months for some farmers to get returns on their crops,

to receive small potatoes, bad apples and dirty beans, while the same farmers puts the clean beans, the large, marketable spuds, and the nice, saleable, red apples, away in good, warm root houses for the better prices in the spring, while the poor merchant has to sacrifice the stuff he had to take from him at 26c on the dollar. That is hardly fair. I do not believe there is any fair minded man that thinks so, is there? But it is done too frequently.

I have bought a few bushels of potatoes and a good many boxes of apples since I came to this country. I have been in orchards buying apples, where nice fruit would be lying around the trees, having been blown off, and have said to the man, "Don't put those in the boxes, will you?" His reply would be, "Why, no, of course not; I feed those to the chickens and hogs." He would bring in his one, two or three hundred boxes of apples, and they would be put into the cellar, along with many other lots from other people. In a short time the whole lot has to be gone over, they are beginning to spoil. You wonder at such nice apples going already, but if you examine them carefully, you will see the ones that are spoiled have been bruised. The man simply could not help packing the apples that fell from the tree,—they looked so nice to him. But I tell you, when an apple falls on the ground, leave it there. At all events, do not put it in with your good apples and take it to the merchant with your first load, for it will surely spoil, and if the merchant is onto himself, he has your name on the end of the box and he will be "leary" of you next year. The Butte and Helena market on Bitter Root apples has been ruined by just this kind of a deal. It has been impossible to ship a car of apples, which was made up by two or more packers, without getting into trouble, for one of the lots is sure to go bad on you. But the shipper has settled with the growers, and so has to stand the loss.

The apple business is only in its infancy with us in Montana. There are the finest apples grown in Missoula and Ravalli Counties that you can find in the world, but I will say to you that few of them are packed the way they should be. Everybody cannot pack apples, but almost everybody that grows them, thinks he can.

I have read papers from orchardists on how to grow and pack apples. I do not know much about the growing part, but I do

know that some people have a heap to learn about packing them. The merchant does not know himself how to pack and grade apples, but he does know what he can sell and what the trade wants. The farmer and orchardist should learn what is saleable with the merchant, and then do his best to meet those requirements, and not try to make the people take what he thinks is right, for people must have what they think is the best, and as they are willing to pay for it, they should have it. So people growing apples must look to the packing and grading, for apples are getting plentiful, new orchards coming in all the time, new ones being planted, and in a few years the fellow that does not have the well packed and well sorted apple will be left. You would be surprised to see the number of people who bring in apples with no mark on the box, don't know the name and five or six varieties in the same box; just simply apples. Of course, you who only see and know of your own lot of apples, and know them to be well sorted and packed, hardly know what the merchant has to contend with, with this class of apple producers, and I tell you there are a lot of them in this part of the country. Your Farmers' Institutes would do a lot of good if you would scatter a lot of literature, treating on "How to Pack Apples," around amongst the apple-growers of Ravalli and Missoula Counties.

I do not say this in a pessimistic way, for all of our crops of apples are not, by any means, packed badly. I have used from some of our own townsman, thousands of boxes of apples this year, and I will say it was a pleasure to sell them, for when we sent out one box or ten boxes, we knew they went to stay, our customer was satisfied, and we got 25 cents per box more than we did for the ordinarily packed apples.

And many other fine packs have come under my observation, showing it easy to do if you want to do so, and make a success of the apple business, which in a few years will be one of our greatest industries.

There is no doubt that in the next year or two there will be built in this city a refrigerator building with a great capacity, in which can be stored all the good apples, where they can be handled and held for good prices, and re-shipped at any time and at a small cost. This will be a good thing for both the farmer and merchant.

A WORD TO THE RANCHMEN.

By G. R. Featherley, Dillon, Montana.

I am pleased to be able to speak a few words to you on this occasion. The Farmers' Institute meetings are, or should be, the occasions when we should get together and compare notes. It should also be the aim of every farmer in this community to be present at these meetings and help, not only with their presence, but also with their voice. We want the benefit of your experience, whether it has been success or failure. We are always ready to publish our success, but seldom say anything about our failures. This is wrong; these failures should be published so that your neighbor may guard against them. Now I want to try and impress upon you the importance of these meetings; not only from the standpoint of the knowledge that we may acquire at them, but from a social standpoint we should get together once in a while and get acquainted, that is, better acquainted with each other. We too often look upon each other as competitors when the fact of the matter is we are nothing of the kind. We are producers with a large and ever increasing market for everything that we produce. We should have no secrets, but ought to always try and excel. The more we can produce on an acre the more valuable that acre becomes, and you should tell your neighbor all about it, which will make our lands more valuable and consequently the country more prosperous.

I have got a good deal out of these institute meetings; I have learned something that I did not know at every one that we have held, and I think that almost every one of you who have attended these meetings will say the same thing. These institutes are held at a time of the year when we can all spare the time and we can well afford to take the time to attend these meetings.

Now, a few words about the year just passing. It has been a peculiar as well as a most prosperous year. Our crops are all good except the first cutting of alfalfa, which was much damaged by the cold weather of the spring. The second cutting in most places, was good. This is accounted for because of the warmer weather. We too often forget that alfalfa is not a native of this climate and, therefore, abuse it. His alfalfa did the best who irrigated it the least. The springs are always cold here and so is the water, therefore we should be careful and not give it too

much cold water. The cold weather we have to take but we can regulate the water.

Our oats made a fine crop and I want to say to you that a good crop of oats can be grown in this valley any year if we but treat it right. You will notice that a great deal of the plowing was done the year before and our oats were put in early and, in a great many instances, were put in on alfalfa land. If we wish to be successful in growing oats we must follow this method. Sow more alfalfa, grow more alfalfa, feed more alfalfa and plow more alfalfa. In this way we can build up our farms and can grow crops of wheat and oats and will surprise you. Why grow 40 bushels per acre when you can just as well raise 80 bushels?

In the stock industry of our county we can see no cause for alarm. The sheep industry has never in its history been as good or with prospects as bright for the future as at the present time. While cattle—that is stock cattle—have not shown any increase, yet it is one of the leading stock industries of our county, and close to twenty thousand head of steers are being fed for the spring markets. The greater part of these are in the Big Hole basin and, whether these steers are fed on wild hay or alfalfa, there is not another country on the globe that can compare with old Beaverhead for cattle fattened on hay alone.

The horse industry is good and the man who is in the horse business with the right kind of goods has no reason to regret having stayed with the business of raising good horses. I want to do a little blowing for our great state. I noticed some figures a short time ago, they are old but good, nevertheless. One hundred and forty-five thousand squares miles of territory occupied by 260,000 people who produce and export products to the amount of \$70,000,000 every year. Two persons to the square mile. These persons produce about \$300 per capita. This is the greatest production per capita of any state in the Union. We have room for millions of new settlers; we have land with soil of unequalled richness and a good healthy climate. Now, in regard to these figures, I am not going to try and make you believe that the ranchers produce all this, because, in fact, they only produce about one-third of the amount exported, but you must remember that perhaps as much more was consumed at home. In March, 1904, 833,960 head of cattle, over 4,000,000

sheep and 182,328 head of horses. All of these taken together were valued at nearly thirty millions of dollars. While the mines are continuing to produce and increase their output of precious metals, yet, if history repeats itself, the time will come when these mines will begin to decrease. With our farms it is different. As long as time goes on, if we farm right, and put back into the soil as much as we take out, we will be able to grow large crops as long as time lasts.

As it stands at the present time, we can not go much further in this valley without the building of large storage reservoirs and a number of these are being constructed at the present time. We have in our own locality a reservoir site of huge proportions, in which if built up to its estimated capacity, water enough can be stored to irrigate over two hundred thousand acres of land. This, gentlemen, means a great deal to us. We can not afford to let this project go without making a most strenuous effort to push it along. Surveys have been made at the lakes which show this project to be the most feasible as well as the cheapest proposition that is under consideration in our state. If this is put through it will make homes for hundreds of farmers on land that is now not considered even good pasture land; land that without water is hardly worth the government price per acre. If this project is put through it will mean a great deal for this part of our county; it will mean a railroad up the valley; it will mean the building of a flour mill and a sugar beet factory. These are some of the enterprises which are sure to spring up when this great amount of new land is put under cultivation. Gentlemen, it is a proposition that is worth all the pushing that you can give it.

Now, gentlemen, just a few words more and the meeting will be yours. We have with us to-day a number of gentlemen from other parts of our state who will talk to you on subjects that should be of interest to you all. These men are successful farmers in their own part of our state and the successful man is the one that you want to hear talk. They are here to tell you their experience. The gentlemen from the Agricultural College, at Bozeman, some of whom have been here before and some of them strangers to us but not to their work. The gentlemen on the program who are residents of our own community are all well known to you and have been successful in their line and are will-

ing to give us their experience. Now, in conclusion, I will ask you to give all of the subjects that may come before us, your most earnest consideration and also remember that we can only get the good out of them by thoroughly discussing them.

INDEX.

	Page.
Address to State Horticulturists.....	259
Alfalfa Growing.....	119
Preparation of Ground.....	120
Time to Sow.....	121
Watering	121
Cutting Back of First Crop.....	121
When to Cut.....	122
How to Cure.....	122
How to Feed.....	123
Pasturing	123
Disking	124
Bacteria and Nodules.....	124
Drills for Alfalfa.....	125
Dodder	125
In Wet Ground.....	126
Sweet Clover, a weed.....	126
Dandelion, a pest.....	127
Dry Farming, on.....	127
Raking and Stacking.....	127
Apples—Varieties—Packing and Marketing.....	183
Beaverhead Dairy Cow, The.....	242
Betterment of Farm Homes, The.....	20
Board of Administration.....	3
Butter Fat in the First and Last Milk From the Cow.....	248
Contents	4
Continued Discussion of Horticulture Law.....	263
Co-operative Canal Construction.....	171
Cream Market of Montana.....	246
Crop Rotation.....	129
Dairying	242
Discussion of Horticultural Law of Montana.....	263
Duty of Water, The.....	166
Farmer and Merchant, The.....	268
Farm Poultry House (Diagram).....	250
Farm Home, The.....	15
Field Crops.....	119
Future of the Sheep Industry.....	228
Handy Cold Room.....	24
Home Water Supply.....	87
Impurities	89
Hard and Soft Waters.....	89
Typhoid Germs.....	92
For Farm Animals.....	93
Horticultural Inspection.....	213
Horticulture	183
How to Keep the Boys and Girls on the Farm.....	31
How to Keep the Boys on the Farm.....	94
Improvement of the Farmers' Schools.....	35
Improvement of Home Grounds.....	79
Discussion of Plans.....	80

	Page.
Improvement of Our Farming.....	143
Discussion	148
Intensive Farming by Aid of Irrigation.....	176
Irrigation	161
Irrigation Canals.....	161
Kind of Cream Wanted.....	247
King Road Drag.....	115
Landscape Gardening.....	71
The Lawn.....	72
Driveways	73
Shrubs	73
Trees	74
Live Stock.....	228
Miscellaneous	259
Originating and Testing Varieties.....	132
Permanent Rural Homes.....	15
Plea for Good Roads.....	111
Poultry	250
Poultry Business as a Profit-Maker.....	252
Public Highways.....	104
Range and Farm.....	235
Report of Secretary.....	9
List of Meetings.....	10
Report of Meetings.....	11
Financial Statement.....	13
Acknowledgments	13
Preface	14
Roads and Highways.....	104
Sheep Industry in its Relation to Range and Farm.....	235
Small Fruits.....	189
Discussion	192
Statute	6
Sugar Beet Growing.....	155
Discussion	158
Truck Farming.....	200
Village and Town Improvement.....	25
Waste Products of Farm and How to Use Them.....	137
What Agricultural Development Means for the Live Stock Interests.	230
What to do With the Unsalable Fruit.....	205
Winter Apples for Montana.....	186
Word to the Ranchmen. A.....	...

INDEX TO NAMES.

	Pages.
Atkinson, A.....	129-146
Bailey, L. H.....	80
Bandmann, Daniel.....	124-125-126-127
Bayliss, Alfred.....	60
Benepe, F. L.....	3
Black, T. T.....	13-159-181-189-193-194-196-197-198-200-212
Booth, Gen.....	159
Breen, Peter.....	263
Bright, O. F.....	15-35
Buck, Henry.....	183
Campbell, C. H.....	127-195
Chesnut, V. K.....	87
Chittenden, Major.....	122
Coburn, Mr.....	126
Colville, H. C. B.....	200
Cooley, R. A.....	213
Cranefield, F.....	79
Dallman, C. F.....	3-29-149-195-196-200-203
Dryden, James.....	250-252
Edwards, C. H.....	186
Elliott, W. J.....	246-248
Elrod, M. J.....	13-94-152-181
Erfert, F. J.....	268
Featherly, G. R.....	272
Fisher, R. W.....	71
Gaddie, Mr.....	157
Good, J. S.....	199
Hall, Frank H.....	15-64-65
Hamilton, John.....	102
Harlan, W. B.....	13-20-24-125-126-148-151-181-192-195-198-204-207-208-211-212-259
Harmon, W. E.....	146
Harvey, L. D.....	58-64
Hays, Geo. M.....	7
Heinze, F. A.....	263
Holden, Prof.....	147
Holt, J. M.....	3
Howard, Dr. L. O.....	213
Kilburn, E. R.....	193
King, Prof.....	178
King, D. Ward.....	115
Linfield, F. B.....	2-3-15-132-142-149-151-152-153-154-158-159-160-176-204-230-235
Marlatt, C. L.....	215
Marshall, Mrs. F. E.....	25
Martin, E. Broox.....	13
McClain, Mr.....	195-197-198-205-207-208-209-210-211-213
McClure, S. W.....	13
Morse, J. E.....	232-233-159-160

	Pages.
Murray, J. P.....	7
Odell, Gov.....	97-98
O'Donnell, I. D.....	13-124-125
Oliver, W. M.....	155-159-160
Power, T. C.....	3
Perkins, Dwight H.....	57
Pitcher, Major.....	122
Read, J. O.....	3
Roosevelt, President.....	16
Sanders, W. F.....	15-259-263-265
Scallon, Mr.....	263
Selway, E. O.....	228
Selway, Herb.....	158
Shannon, Mr.....	210
Show, Prof. Robert.....	182
Smith, Gov.....	268
Stahl, Louis.....	242
Story, Mr.....	123
Sutherlin, Mr.....	126-149-148-151-154
Tannatt, E. T.....	111-161
Terry, T. B.....	152-204
Toole, J. K.....	2-3-7
Traphagen, Prof.....	212
Van Rensselaer, Mrs.....	71
Van Dreser, Henry.....	257
Washington, George.....	264
White, B. F.....	7
Whiteside, Fred.....	13-137
Williams, Mrs. D. S.....	31
Woodhouse, Mr.....	157
Wooldridge, W. M.....	15-171
Wylie, W. W.....	3-119-124-125-126-127-150-151-153

